SHIMADZU

# Instruction Manual
# UV-1601
# Operation Guide

SHIMADZU CORPORATION
ANALYTICAL INSTRUMENTS DIVISION
KYOTO JAPAN

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206-93070C

# INSTRUCTION MANUAL

## Operation Guide

## UV-1601

## SHIMADZU RECORDING SPECTROPHOTOMETER

## (P/N 206-67001)

Read the instruction manual thoroughly before you use the product. Save this instruction manual with care so that you can use it any time you need it.

SHIMADZU CORPORATION

ANALYTICAL INSTRUMENTS DIVISION

KYOTO, JAPAN

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# Precautions for safe operation

UV-1601 is an ultraviolet visible spectrophotometer.

To operate the unit safety, strictly observe the following precautions.

1. Do not use the unit for any purpose other than the above-mentioned types of analysis.

2. Follow the procedures described in the user's manual.

3. Observe all warnings and cautions.

4. Do not disassemble or modify the unit without the express approval of an authorized Shimadzu Representative.

5. For internal repair of the product, contact your Shimadzu Representative.

MEANING OF CAUTION SIGNS

| | |
|---|---|
| WARNING | indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or moderate injury. |
| CAUTION | indicates a potentially hazardous situation which, if not avoided, may result in minor injury, or may result in machine damage. |
| NOTE | is used to emphasize essential information. |

# Warning labels indicated on the unit

## WARNING

### High Temperature

Light source and light source chamber are very hot. When replacing the light source, be sure to turn OFF the power and check that the light source is completely cooled.

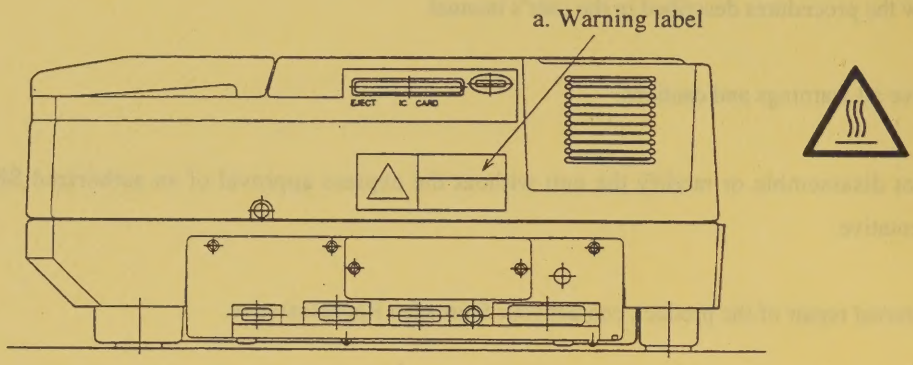


**Fig. 1 UV-1601**

## WARNING

### Electric Shock

When replacing the fuse, be sure to turn OFF the power and disconnect the power supply cord.

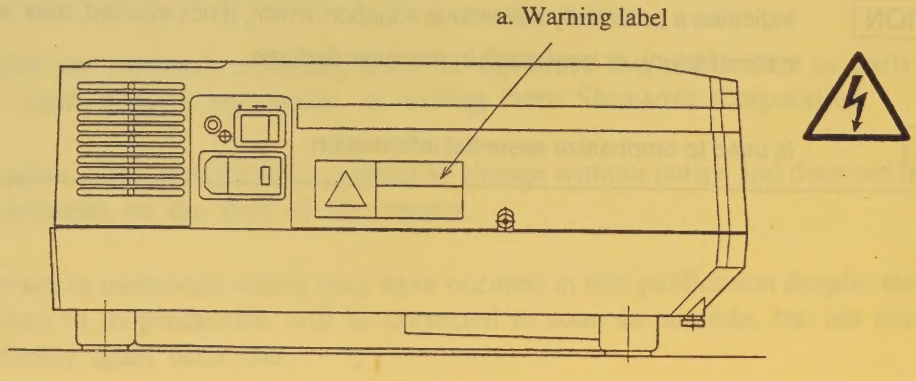


**Fig. 2 UV-1601**

# Preface

Thank you for your purchase of the Shimadzu Recording Spectrophotometer UV-1601.

The UV-1601 is a newly designed instrument equipped with all of the basic spectrophotometer functions in a compact body. The UV-1601 can also be applied to a variety of analysis using our optional software, available on IC cards.

In order for you to fully employ and effectively utilize the functions of this instrument, it is recommended that you carefully read this manual before using the UV-1601, and thereafter keep it close at hand for future reference.

This Instruction Manual (Operetion Guide) describes the operation of this instrument.
In Chapter 1, the basic key operations, etc. will be explained.
The software for this instrument basically comprises 8 modes for measurement (or data processing, instrument parameter setting, etc.). Chapter 2 describes the methods for selecting these modes and the operations which are shared by several of the measurement modes.
From Chapter 3 on, the details about operation in the various modes are explained.
Of the operations which are shared by the various modes, "Sample Module Control" and "PC Control" are treated in detail in Chapter 11 and Chapter 12.

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# Chapter 1. Before Operating...

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# 1.1 Turning ON Power and Initialization



When the power is turned ON, the spectrophotometer is checked and initialized according to the items shown in the screen in Figure 1.1. The time required for this initialization is approximately 3 minutes 30 seconds if all of the items are properly completed. As each item enters its initialization operation, it is highlighted. Then, when the initialization for that item is properly completed, the star next to it is also highlighted. However, if any abnormality is detected, the initialization process is interrupted at that item, without its star being highlighted. Please refer to the "Installaton & Maintenance Manual", "3.2 Initialization and Error Display" regarding the content of the checks performed for each item and the points to check if an error is indicated.

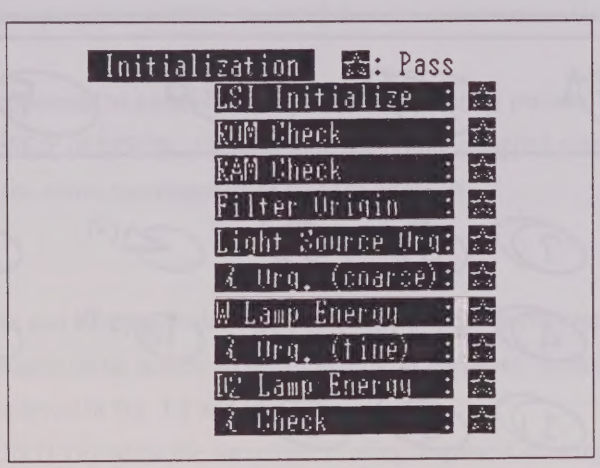


**Fig. 1.1 Initialization screen**

# 1.2 Explanation of Operating Keys

The UV-1601 keyboard is shown in Figure 1.2. The modes and settings in the various screens can be selected using the number keys 0 through 9 or the function keys F1 through F4. When selecting modes or settings, it is not necessary to press the ENTER key after you have pressed the number keys or function key. On the other hand, when entering numeric values, such as wavelength settings orm display mode, etc., you must press the ENTER key to confirm that value.

Otherwise, refer to the "Installaton & Maintenance Manual", "2.3 Keyboard" for details.

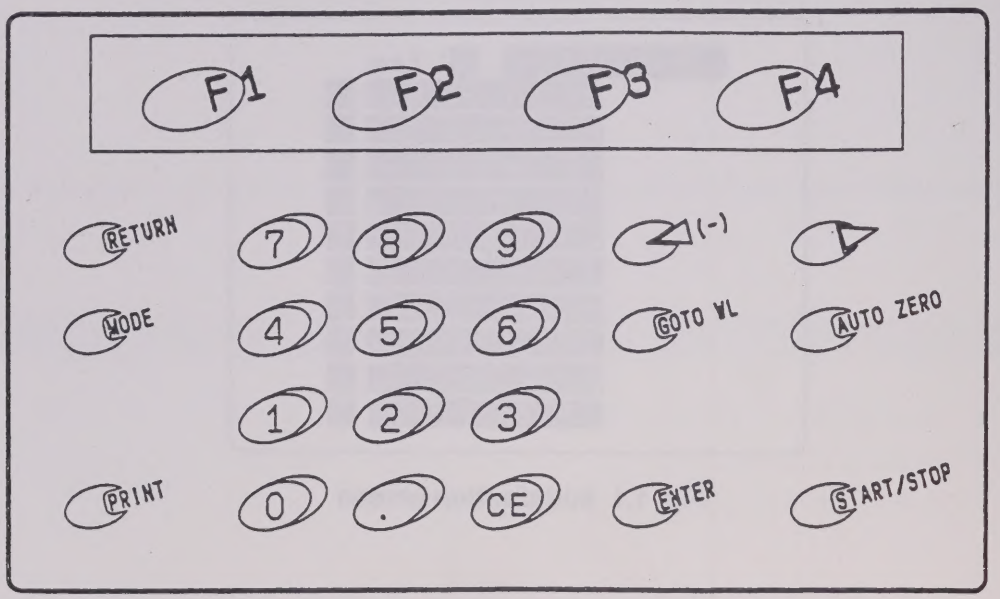


**Fig. 1.2 Keyboard**

# 1.3 Screen Copy and Data Printout



When the thermal printer HCP-1A (optional) (P/N 206-81009) is installed, the UV-1601 can print out hard copies of the screen or the measurement results. Connecting this printer makes the following 3 types of printouts possible.

(1) Hard copy of screen : Press the [PRINT] key to print a hard copy of the screen.

(2) Print using function keys: When a function key has a [Print Out] function, as in a mode such as Photometrics in which the measurement results are recorded in table form, all of the tabular data will be printed out.

(3) Print numeric data for : In modes in which the measurement results are obtained as numeric values, as each measurement is acquired (as with Photometric) these measurements will automatically be printed.

The UV-1600 can be connected to a commercially available printer for personal computer that conforms to the printer command ESC/P of EPSON. Connecting to the printer complied with ESC/P enables following output in addition to the above mentioned three types of printouts.

(4) Print waveform

In the spectrum mode and kinetics mode, it is possible to plot the waveform (spectrum) on A4 size paper when it is displayed on the screen. It is half as large as A4 paper. Examples in each mode by the 24-pin printer are displayed in Fig. 1.3 and Fig. 1.4.

By pressing the [PRINT] key while the waveform is being displayed, printing of the waveform or its hard copying can be selected.

For the connection of the printer, refer to the "5.1 Printer" of the "Instruction manual - Installation and Maintenance".

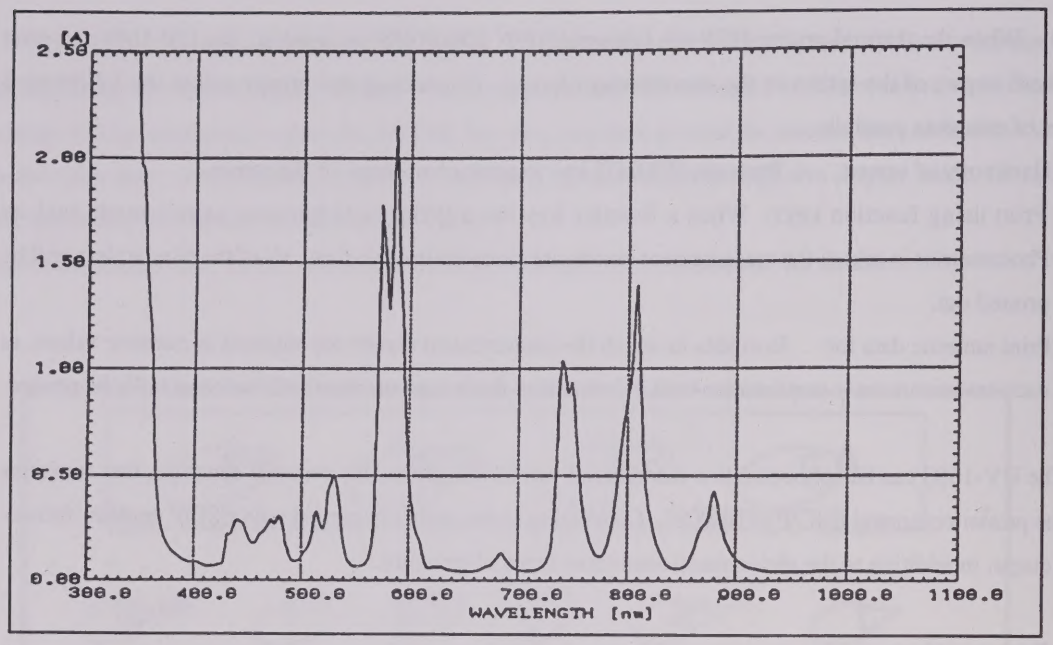


Fig. 1.3 Waveform print(Spectrum mode)

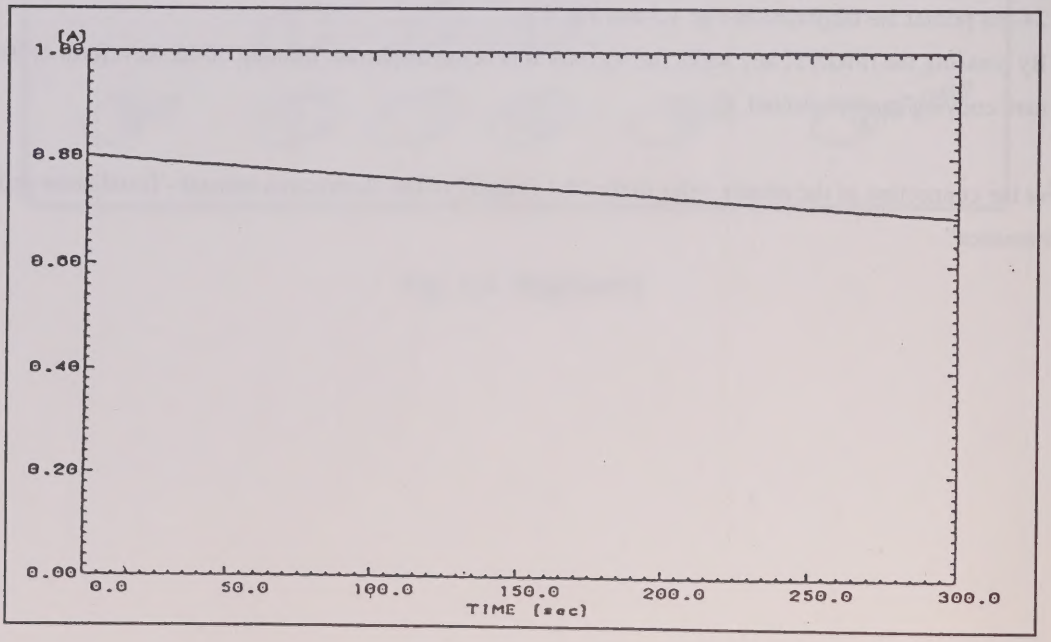


Fig. 1.4 Waveform print(Kinetics mode)

# Chapter 2
# Mode Selection and Shared Operations

The Mode Selection screen which is displayed after initialization is completed, and the operations which are shared by the various modes are explained in this chapter.

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# 2.1 Mode Selection Screen

After initialization is completed, the Mode Selection screen is displayed.

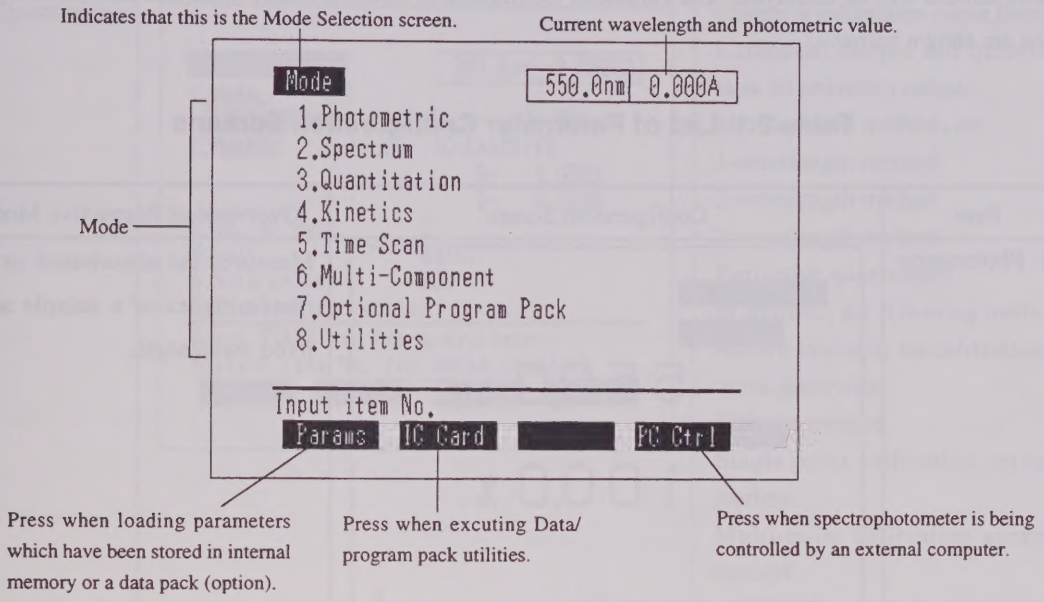



**Fig. 2.1 Mode Selection screen**

Enter an item number 1. through 8. to select that mode.

When you select the respective modes, the Parameter Configuration screen shown in "2.2 Overview of Various Modes" will be displayed.

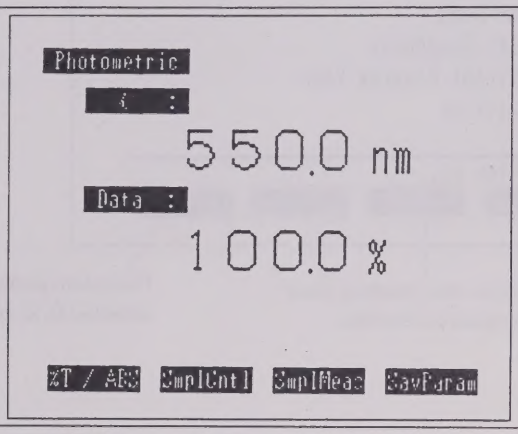
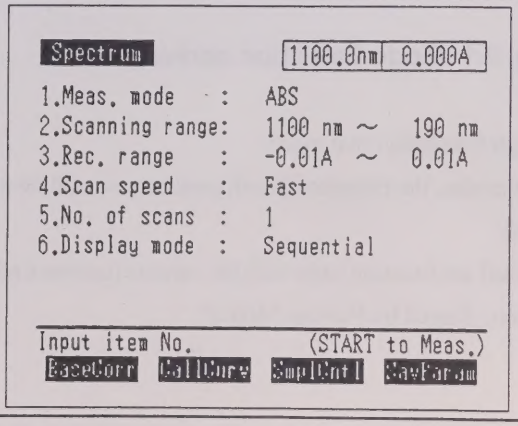
[Params], [IC Card] and [PC Ctrl] are function keys with the various functions noted in Figure 2.1. These are explained in "2.3 Operations Shared by Various Modes".

# 2.2 Overview of Various Modes

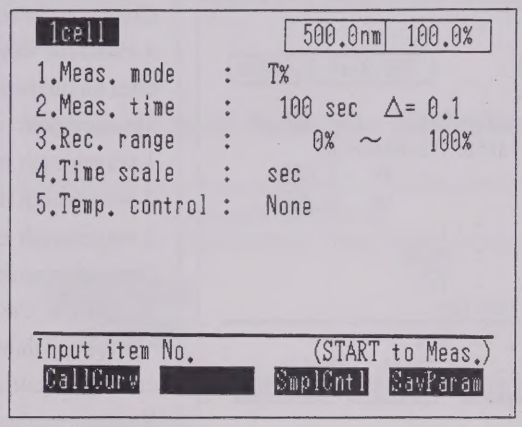
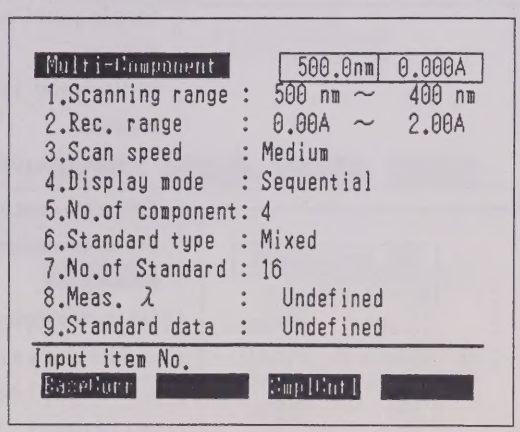
When you select the various modes in the Mode Selection screen, their respective Parameters Configuration screens will be displayed. The Parameter Configuration screen for each mode and an overview of each are shown below.



**Table 2.1 List of Parameter Cnofiguration Screens**

| Item | Configuration Screen | Overview of Respective Mode |
|---|---|---|
| 1. Photometric |  | Measures the absorbance or % transmittance of a sample at a fixed wavelength.<br>(See Chapter 3 Photometric) |
| 2. Spectrum |  | Scans a wavelength range to measure the absorbance and % transmittance of a sample as a function of wavelength.<br>Single beam energy measurement can also be performed.<br>(See Chapter 4 Spectrum) |

| Item | Configuration Screen | Overview of Respective Mode |
|---|---|---|
| 3. Quantitation | Quantitation 700.6nm 0.0000A<br>1.Meas. : 3λ<br>λ1= 700.0 λ2= 650.0 λ3= 600.0<br>2.Method : K-factor (C=K*ABS+B)<br>K= 1.0000<br>B= 0.0000<br>3.No. of Meas. : 1<br>4.Unit : mg/ml<br>5.Data print : YES<br>6.Baseline correction<br>Press START key for measurement<br>(Select item No. for param. change)<br>SmplCntl SmplMeas SavParam | Creates a calibration curve from a standard sample and quantitates an unknown sample.<br>Measurement methods are<br>1-wavelength method<br>2-wavelength method<br>3-wavelength method<br>Derivative quantitation<br>In addition, the following methods are available for calibration curve generation<br>K-factor method<br>Single point calibration curve method<br>Multi-point calibration curve method<br>(See Chapter 5 Quantitation) |
| 4. Kinetics | 1 λ 500.0nm 0.000A<br>1.Meas. time : 100 sec Δ= 0.1<br>Lag / Rate : 10 sec/ 90 sec<br>2.Factor : 1) 1.0000 2) 1.0000<br>3) 1.0000 4) 1.0000<br>3.Rec. range : 0.00A ~ 2.00A<br>4.Temp. control : None<br>5.Time scale : sec<br>Input item No. (START to Meas.)<br>CalCurv DataList SmplCntl SavParam | Calculates enzyme activity from the time-dependent change in absorbance.<br>Up to 16 samples can be measured at once using a multi-cell holder, micro multi-cell, or CPS-240 (all options). Time-dependent changes in % transmittance can also be measured.<br>Following measurement methods are available.<br>* 1-wavelength Kinetics measurement<br>* Multi-cell Kinetics measurement<br>* 2-wavelength Kinetics measurement<br>* Rate measurement<br>(See Chapter 6 Kinetics) |

| Item | Configuration Screen | Overview of Respective Mode |
|---|---|---|
| 5. Time Scan |  | This function is used to measure the change in time of absorbance, transmittance, or energy in the specified wavelength. Up to 16 samples can be measured using the multi-cell, micro multi-cell, or CPS-240 (all options).<br><br>(See Chapter 7 Time Scan Mode) |
| 6. Multi-componento |  | Enables samples with up to 8 constituent components to be measured and quantitated.<br><br>(See Chapter 8 Multi-component) |

| Item | Configuration Screen | Overview of Respective Mode |
|---|---|---|
| 7. Optional Program Pack | | Select this when using the optional program pack.<br>(See Chapter 9 Optional Program Pack) |
| 8. Utilities | Utilities<br>1.Start program : Standard menu<br>2.Data display : 4<br>3.S/R exchange : Standard<br>4.Light source : 340.8<br>5.Printer : ESC/P<br>( L.margin = 5 )<br>6.Clock set : 05/Apr/96 09:27:41<br>7.D2 lamp off time: ∞<br>8.Beep : ON<br>9.Maintenance<br>Input item No. | This is the mode for setting and changing the basic operating parameters of the instrument.<br>(See Chapter 10 Utilities) |

Operations which are shared by several of the modes will be explained here. The operations which are unique to the various modes will be explained in the chapter on the respective mode.

### 2.3.1 Load Parameters [Params]

Mode Selection screen (F1) key

In order to facilitate entering measurement parameters for each application, you can save the measurement mode and measurement parameters in memory and then load them from the Mode Selection screen. (Refer to "2.3.4 Save Parameters" about saving measurement parameters.)

Up to 16 sets of measurement parameters can be stored in the instrument memory, and if a data pack (option) is used, a total of 95 parameter sets can be stored.

When you select [Params], the parameter file list will be displayed.

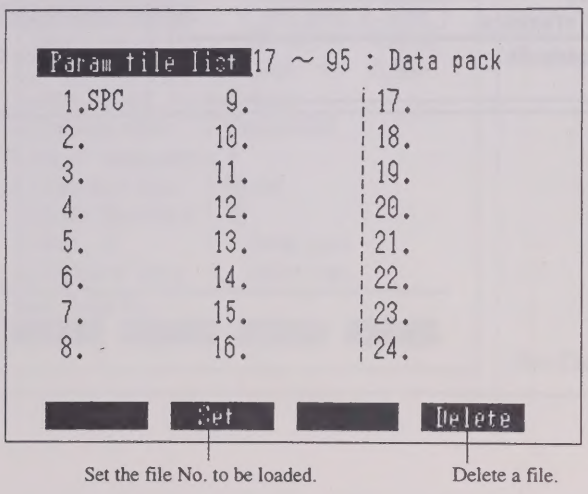



**Fig. 2.2 Parameter file list**

Select [Set] and enter the file No. for the parameters to be loaded. The screen will switch to the Parameters Configuration screen for the measurement mode stored in that file.

You can delete the file corresponding to the specified number after selecting [Delete].

You can also use the ◁ ▷ keys to change the page displayed in the Parameter file list screen.

### 2.3.2 IC Card [IC Card]

Mode Selection screen (F2) key

This displays the Data/program pack utilities screen.

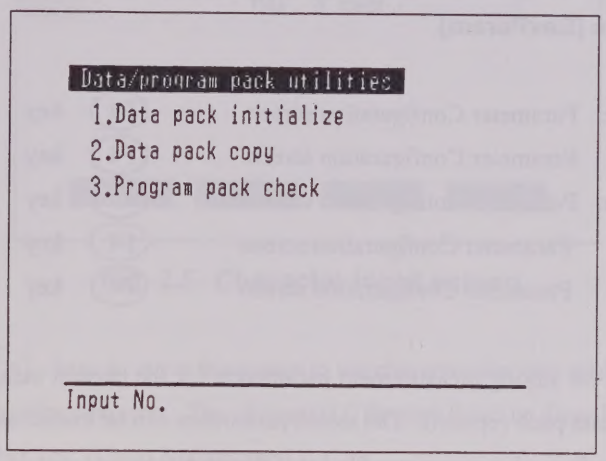



**Fig. 2.3 Data/program pack utilities screen**

There are 3 functions available for the optional IC cards (data pack and program pack).

<1. Data pack initialize>

This function is the equivalent of a disk format on a personal computer.

A data pack absolutely must be initialized before it is used.

CAUTION! Initializing a data pack that is in use will delete all of the information stored on it.

<2. Data pack copy>

This function copies the contents of one data pack to another data pack. Due to the memory capacity of the instrument, the copy processes is divided into two steps. Therefore, it will be necessary to insert the data packs (source and destination) two times each. Please note that the optional program pack cannot be copied.

<3. Program pack check>

This is to check the contents of the program pack. The results of the title, mode No., version no. and check sum (check for content errors) checks will be displayed.

### 2.3.3 PC Control [PC Ctrl]

Mode Selection screen (F4) key

Please see "Chapter 12 PC Control" regarding the [PC Ctrl] key.

### 2.3.4 Save Parameters [SavParam]

| | | |
|---|---|---|
| Photometric | Parameter Configuration screen | (F4) key |
| Spectrum | Parameter Configuration screen | (F4) key |
| Quantitation | Parameter Configuration screen | (F4) key |
| Kinetics | Parameter Configuration screen | (F4) key |
| Time Scan | Parameter Configuration screen | (F4) key |

This is the function for saving measurement parameters for the current measurement mode in the instrument memory or a data pack (option). The stored parameters can be loaded using [Params].

When you select [SavParam], a parameter file list is displayed.

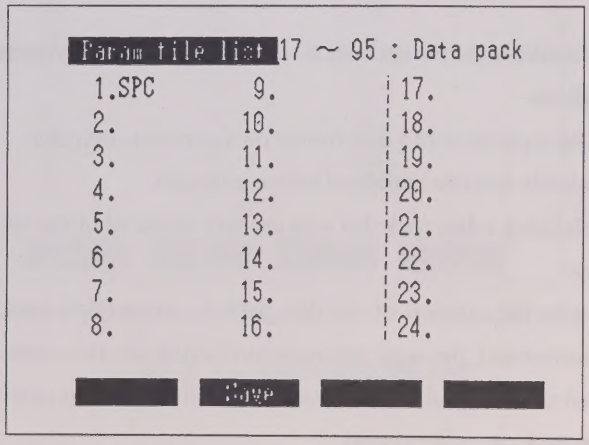



**Fig. 2.4 Parameter file list**

NOTE! Note that the measurement parameter of accessory is connected to sample compartment is not saved.

When you select [Save] and enter the file No. in which the parameters are to be saved, Character input screen will be displayed.

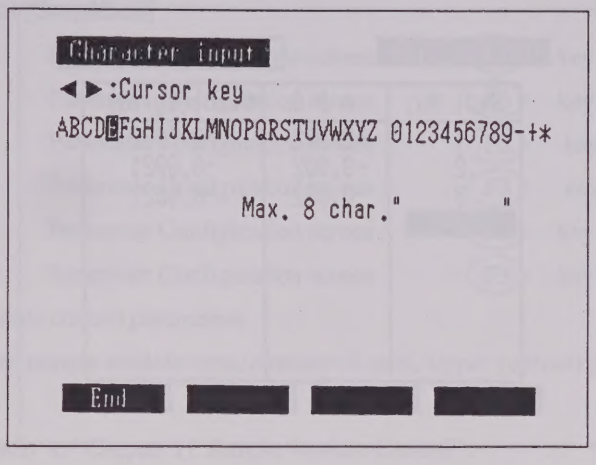



**Fig. 2.5 Character input screen**

Use the ◁ ▷ keys to move the cursor to the character that you wish to enter and then press the [ENTER] key to input the character. The characters 0 through 9 can be directly entered by pressing the corresponding number key. (Up to 8 characters)

If you make a mistake entering a character, you can delete it with the [CE] key.

The space between the Z and 0 (zero) is a "space" which can also be entered. However, a "space" can not be placed at the front of a filename.

When you are finished entering and select [End], the measurement parameters will be saved to the file of the specified number under the filename which was entered.

### 2.3.5 Measurement Screen [SmplMeas]

Photometric Parameter Configuration screen (F3) key
Quantitation Parameter Configuration screen (F3) key

In modes which handle numeric data, such as photometric values and concentrations, etc., you can switch from the parameter configuration screen to a measurement screen that displays the measured values.

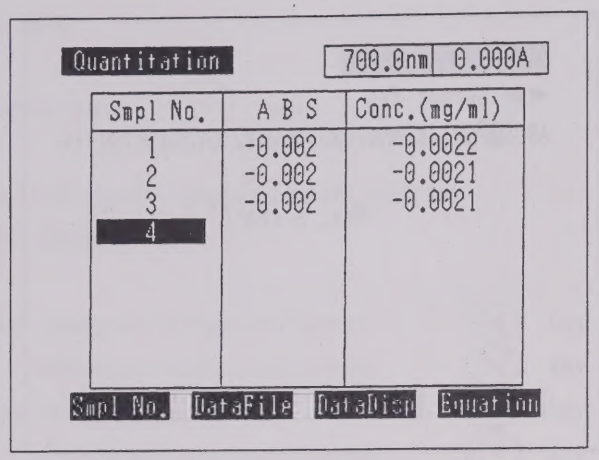



**Fig. 2.6 Photometric measurement screen**

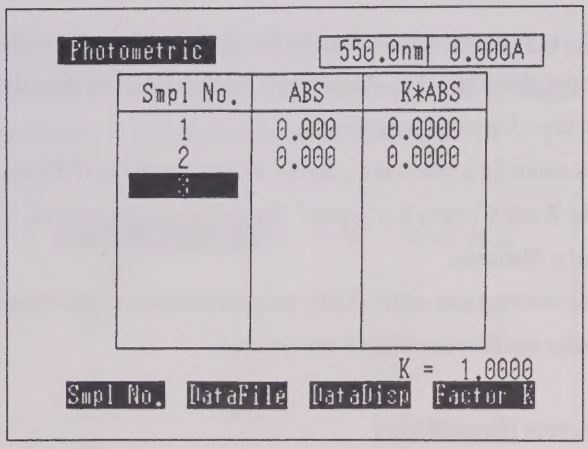



**Fig. 2.7 Quantitation measurement screen**

### 2.3.6 Start Measurement

(START) key

In the Photometric, Spectrum, Quantitation, Kinetics, and Time Scan modes, you can start measurement by pressing the [START] key in the Parameter Configuration screen or the Measurement screen.

Please refer to Chapter 8 Multi-component Quantitation Mode" regarding that mode.

### 2.3.7 Sample Control [SmplCntl]

| | | | |
|---|---|---|---|
| Photometric | Parameter Configuration screen | (F2) | key |
| Spectrum | Parameter Configuration screen | (F3) | key |
| Quantitation | Parameter Configuration screen | (F2) | key |
| Kinetics | Parameter Configuration screen | (F3) | key |
| Time Scan | Parameter Configuration screen | (F3) | key |
| Multicomponent | Parameter Configuration screen | (F3) | key |

Set the sample module control parameters.

Settings include the sample module type, number of cells, sipper (option) parameter settings, black correction, etc.

For more details, refer to "Chapter 11 Sample Module Control".

### 2.3.8 Baseline Correction [BaseCorr]

| | | | |
|---|---|---|---|
| Spectrum | Parameter Configuration screen | (F1) | key |
| Quantitation (except for 1-wavelength quantitation) | | | |
| | Parameter Configuration screen | (6) | key |
| Kinetics (2-wavelength) | | | |
| | Parameter Configuration screen | (7) | key |
| Multicomponent | Parameter Configuration screen | (F1) | key |

This function corrects the baseline in measurement modes which perform wavelength scanning or multi-wavelength measurement.

Baseline correction under the set measurement parameters is started by pressing a key.

To stop correction while it is in process, press the [START/STOP ] key.

### 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv]

[SavCurve] is the function which saves spectrum data or time course data to a file.

Also, [CallCurv] is the function for loading to the screen curves which have been saved in a file.

Up to 6 curves can be saved in the instrument memory, while a total of 32 can be saved if an optional data pack (option) is used.

Of these, the data measured in the immediately preceding measurement are automatically saved in the dedicated File No. 0 (zero) under the filename "Original", and data cannot be manually saved to this file using [SavCurve].

These functions for handling curves are available in the Spectrum, Kinetics, Time Scan, and Data Processing modes.

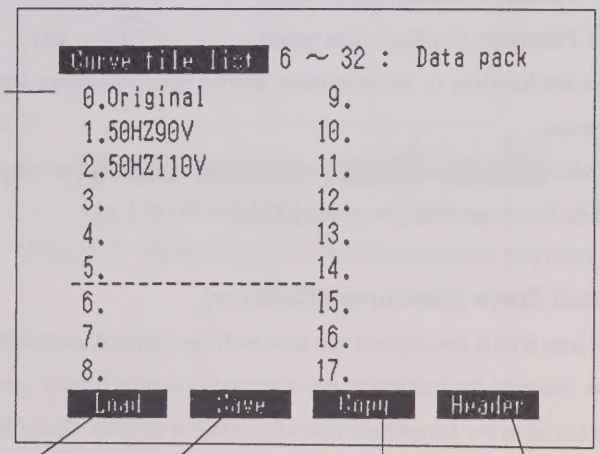
In addition, the [CallCurv] function is also available in the Multicomponent mode.

(Chapter 8 Multi-component Quantitation Mode)

| | | | |
|---|---|---|---|
| [SavCurve] | Spectrum | Measurement screen | (F4) key |
| | Kinetics | Measurement screen | (F4) key |
| | Time Scan | Measurement screen | (F4) key |
| | Data Processing | Processing screen | (F4) key |

| | | | |
|---|---|---|---|
| [CallCurv] | Spectrum | Parameter Configuration screen | (F2) key |
| | Kinetics | Parameter Configuration screen | (F1) key |
| | Time Scan | Parameter Configuration screen | (F1) key |
| | Multi-component | Measurement screen | (F2) key |
| | Data Processing | Item Selection screen | (F2) key |

When you select [SavCurve] or [CallCurv], a Curve file directory is displayed on the screen. Now, if there are no measurement data from an immediately preceding measurement, the [Save] function will not be displayed.




The most recently acquired data are automatically saved in File No. 0 (zero) under filename Original.

Specify a file No. to display the data on screen.

Save data.

Copy data in one file to a different file No.

Display a list of the contents of each file.

**Fig. 2.8 Curve file directory screen**

The displayed page of the Curve file directory screen can be switched using the (◁) (▷) keys.

[Load]

This displays the data for the specified file No. on the screen.

If the data type (the vertical axis unit and measured mode are the same) and horizontal axis units match, data can be overlaid on the same screen by consecutively entering file Nos.

When overlaying data, the vertical and horizontal axes for the initially displayed data will be displayed.

| NOTE! | Since the files which are displayed on the curve file screen or the data file screen use the same area of memory, exactly identical files will be displayed. Consequently, the data files for the various modes are mixed together. Files of different modes cannot be displayed on screens of the measurement mode. |
|---|---|

[Save]

This saves measured or processed data in memory areas No. 1 through 32.

When you press [Save], you will be instructed on the screen to enter a file No. When you enter a file No. 1 through 32, the Character input screen will be displayed.

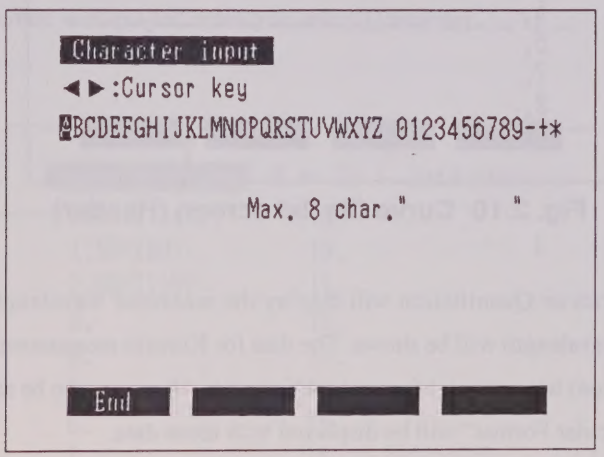



**Fig. 2.9 Character input screen**

Use the ◁ ▷ keys to move the cursor to the character that you wish to enter and then press the [ENTER] key to input the character. The characters 0 through 9 can be directly entered by pressing the corresponding number key. (Up to 8 characters)

If you make a mistake entering a character, you can delete it with the [CE] key.

The space between the Z and 0 (zero) is a "space" which can also be entered. However, a " space" can not be placed at the front of a filename.

When you are finished entering and select[ End] , the measurement parameters will be saved to the file of the specified number under the filename which was entered.

[Copy]

You can copy data between file Nos. 0 through 32. Specify the copy source and copy destination file Nos. as instructed on the screen. No. 0 can't be specified as the destination.

[Header]

You can display the range of the horizontal axis (measurement time or wavelength range) and the units thereof (sec, min, nm) as well as the units of the vertical axis (ABS, T%, E) in the list (Curve file list) so as to see the type of data saved in each of the file Nos. 0 through 32.

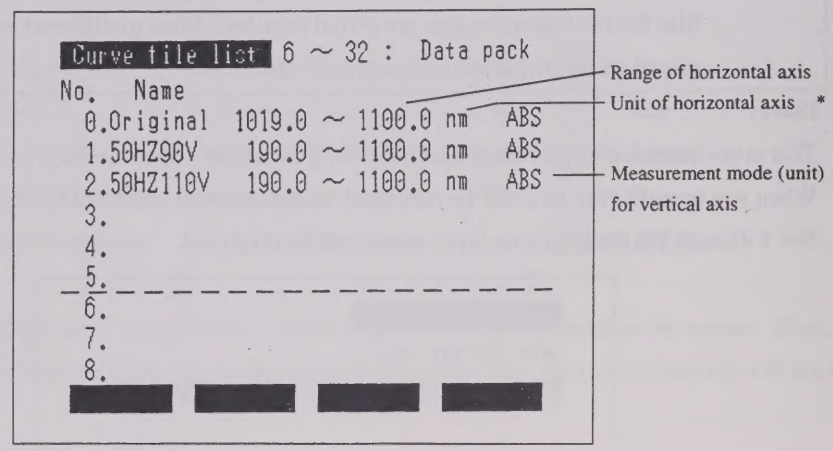



**Fig. 2.10 Curve file list screen (Header)**

* The data for Photometrics or Quantitation will display the measured wavelength. In the 2 λ or 3 λ quantitation, the longest wavelength will be shown. The data for Kinetics measurements done using a multi-cell or CPS-240 (both option) has a special format in which up to 16 curves can be simultaneously saved in one file. Therefore,"Particular Format" will be displayed with those data.

File No. 0 "Original" ;

The most recently acquired data are automatically saved in the dedicated File No. 0 (zero) under the filename "Original".

The screen can be returned to the immediately preceding condition after file processing, such as display, copy, or data processing ("Chapter 11 Data Processing Mode") have been performed by loading file No. 0.

Other data cannot be saved in file No. 0.

### 2.3.10 Data Management [DataFile]

| | | | |
|---|---|---|---|
| Photometric | Measurement screen | (F2) | key |
| Quantitation | Measure Unknown Sample screen | (F2) | key |
| Kinetics | Data Display (Data table) | (F1) | key |

Numeric data tables, such as the photometric values and concentrations obtained in the Photometric and Quantitation modes, can be saved to and loaded from the instrument memory or an data pack (option).

Up to 6 files of data tables can be saved in the instrument memory, while if an data pack (option) is also used, a total of 32 files can be saved.

In addition, the maximum quantity of data comprising the various data tables is 166 data for Photometric mode and 182 data for Quantitation mode.

Of these, the table data up to the immediately preceding measurement are automatically saved in the dedicated File No. 0 (zero) under the filename "Original".

The Data file list screen is displayed when you select [DataFile].

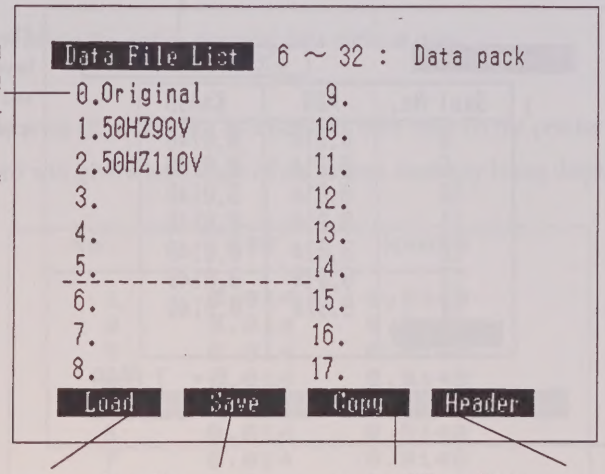



**Fig. 2.11 Data File List screen**

The operation of each function is the same as [SavCurve] and [CallCurv].
Now, if there are no measurement data from the immediately preceding measurement, the [Save] function is not displayed.

### 2.3.11 Data Display [DataDisp]

| | | |
|---|---|---|
| Photometric | Measurement screen | (F3) key |
| Quantitation | Measure Unknown Sample screen | (F3) key |
| Kinetics | Measurement screen (Data table) | (F4) key |

It is possible to display numeric data tables in the Photometric, Quantitation and Kinetics modes.

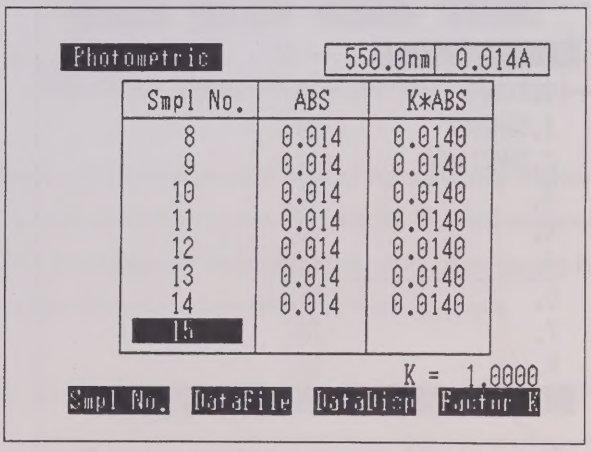
In measurements which handle numeric data, as the measurement is repeated, the data are successively scrolled across the screen and no more than the immediately preceding 8 data can be displayed on the screen.

The display data function enables the data which preceded these 8 to be displayed.

The amount of data which can be displayed using [DataDisp] is up to 166 in Photometric mode, 182 in Quantitation mode and 133 in Kinetics mode.

For example, an instances in which sample Nos. 1 through 14 were measured in the Photometric mode is shown below.

[DatDisp] in the Kinetics mode may have some different operations. See Chapter 6 "Kinetics Mode."




The data for Nos. 1 through 7 have been scrolled off-screen and cannot be seen in this screen.

**Fig. 2.12 Measurement screen example (Nos. 1 through 14)**

When you select [DataDisp], the display will change to the Data Display screen.

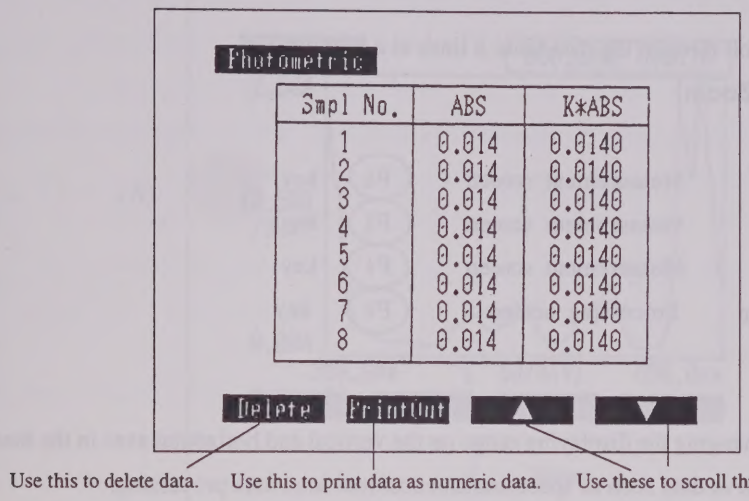



**Fig. 2.13 Data Display screen (Photometric mode)**

[Delete]

This enables you to delete the entire numeric data table at once.

[PrintOut]

This enables you to print all of the data as a numeric data table on the printer (option). (The [PRINT] key on the keyboard will give a hard copy of the screen currently being displayed.)

| No. | ABS | K*ABS |
|---|---|---|
| 1 | 0.014 | 0.0140 |
| 2 | 0.014 | 0.0140 |
| 3 | 0.014 | 0.0140 |
| 4 | 0.014 | 0.0140 |
| 5 | 0.014 | 0.0140 |
| 6 | 0.014 | 0.0140 |
| 7 | 0.014 | 0.0140 |
| 8 | 0.014 | 0.0140 |
| 9 | 0.014 | 0.0140 |
| 10 | 0.014 | 0.0140 |
| 11 | 0.014 | 0.0140 |
| 12 | 0.014 | 0.0140 |
| 13 | 0.014 | 0.0140 |
| 14 | 0.014 | 0.0140 |

**Fig. 2.14 Printer output (Photometric mode)**

[▲][▼]

These enable you to scroll through the data table 8 lines at a time.



### 2.3.12 Enlarge/Reduce [Zoom]

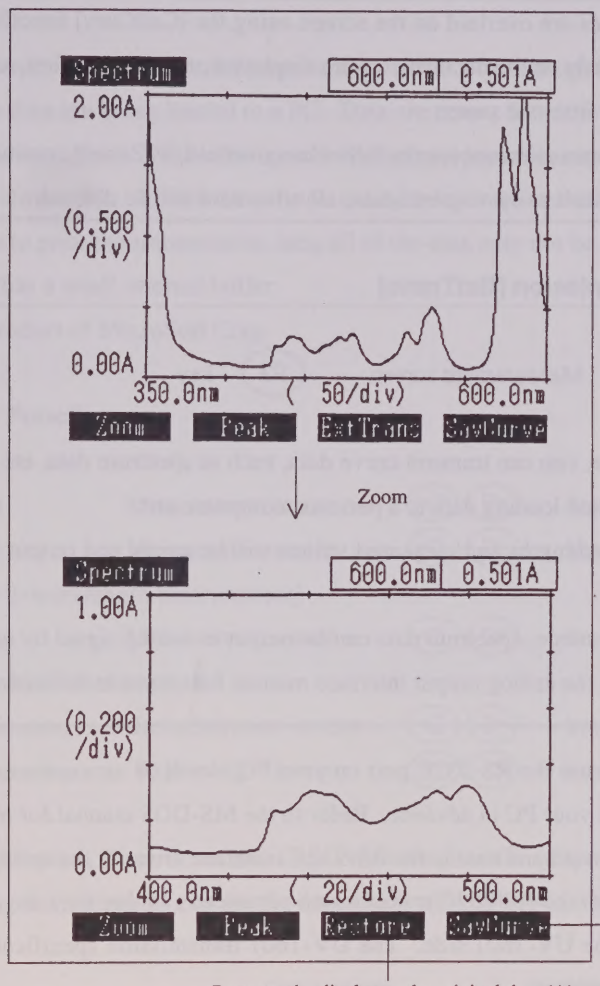
| | | |
|---|---|---|
| Spectrum | Measurement screen | F1 key |
| Kinetics | Measurement screen | F1 key |
| Time Scan | Measurement screen | F1 key |
| Data Processing | Processing screen | F1 key |



This is the function to changing the displaying range on the vertical and horizontal axes in the measure mode which deals with the curve data such as spectrum/kinetics/time scan/data processing.

Select [Zoom] and enter the values for the vertical axis maximum and minimum and horizontal axis minimum and maximum, in that order, to change the ranges on the vertical and horizontal axes.

If you press the ◁ ▷ keys while entering horizontal axis values, the cursor will be displayed, enabling data values to be read directly from the curve. Press [Enter] while the cursor is displayed and the value of the point on the horizontal axis on which the cursor is resting at that time will become the entered value.




(A)

(B)

Spectrum screen
Select [Zoom]

Example where the 0~1Abs range on vertical axis and the 400~500nm range on the horizontal axis in (A) is zoomed.

Saves the data in (B).

Restores the display to the original data (A).

(A) Spectrum screen

(B) Zoomed screen

**Fig. 2.15 Zoom function**

Select [Restore] to return the zoomed data to the original data.

Even if you execute [Zoom] again, [Restore] will return to the (A) display.

You can save the data resulting from the [Zoom] by selecting [SavCurve] in the (B) display (see 2.3.9 Save Curve and Call Curve).

NOTE! 1) If curves are overlaid on the screen using the [CallCurv] function, a [Zoom] will be executed only on the data which were displayed on the screen first, and the other data will be deleted from the screen.

2) When measurement results have been overlaid, a [Zoom] command will be executed on the most recently acquired data; all other data will be deleted.

### 2.3.13 External Transmission [ExtTrans]

Spectrum Measurement screen (F3) key

In the Spectrum mode, you can transmit curve data, such as spectrum data, etc., as text data from the RS-232C port. Use this when loading data to a personal computer, etc.
On spectrum data, the wavelengths and measured values will be paired and output from the higher to the lower wavelength.

Also, in the spectrum mode, spectrum data can be output in analog signal by using the analog output interface (option). Refer to the analog output interface manual for output to the analog output interface.

NOTES! In order to use the RS-232C port on your PC, it will be necessary to make the following settings on your PC in advance. Refer to the MS-DOS manual for more details.

(1) Install and enable the RS-232C interface driver in the system.

(2) Set the RS-232C transmission parameters so that they are the same as those on the UV-1601 side. The UV-1601 transmission specifications are Baud rate: 9600bps

| | | |
|---|---|---|
| Data bit length | : | 7 |
| Stop bit | : | 1 |
| Parity | : | Odd |
| X-parameter | : | None |

Refer to "12.1 Connecting to PC" for information on the connection cable.

Use the MS-DOS COPY command for loading on the PC side. The COPY command receives data over the RS-232C port. Enter

COPY AUX DATA.1

and then press the [ExtTrans] key on the UV-1601 to input the currently displayed data from the RS-232C port (snown as AUX) and save it under the filename DATA.1.

The external transmission function comprises one-direction transmission of data from the

UV-1601.

Data transmission is executed continuously in one direction at a speed which presumes that the data are being loaded to a PC. Data are output from the RS-232C port approximately every 20ms. While this speed will be appropriate for most PCs, data may be lost with a slower PC. In addition, if you connect a printer to the RS-232C interface and attempt to print the transmission data, all of the data may not be able to be printed if the printer has a small internal buffer.

* MS-DOS is a product of MicroSoft Corp.

### 2.3.14 Read Cursor Function

| | | |
|---|---|---|
| Spectrum | Measurement screen | ◁ ▷ keys |
| Kinetics | Measurement screen | ◁ ▷ keys |
| (Only for 1-wavelength measurement) | | |
| Time Scan | Measurement screen | ◁ ▷ keys |
| (Only for 1-cell measurement) | | |
| Data Processing | Item Selection screen | ◁ ▷ keys |
| Data Processing | Processing screen | ◁ ▷ keys |

In the Spectrum, Kinetics, Time Scan, and Data Processing modes, you can use the cursor to read values at any point along the horizontal axis for the data which are displayed on the screen.

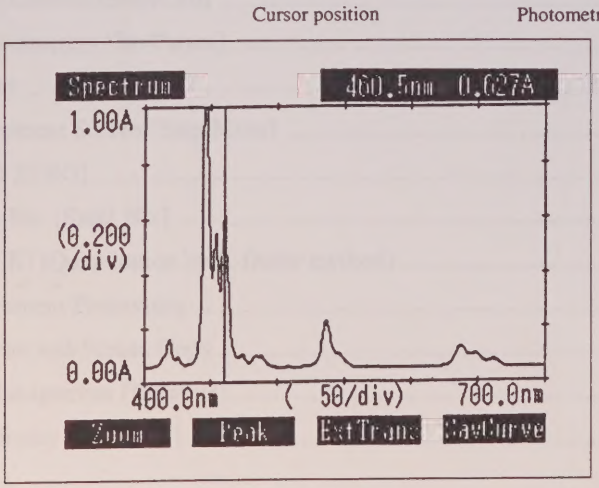



**Fig. 2.16 Read cursor screen (Spectrum)**

In a screen in which a spectrum, etc. is being displayed, the cursor will be displayed when you press a cursor key (◁ ▷). Hold the cursor key down to move the cursor quickly. At the same time, The frame at the top-right of the screen which normally displays the current wavelength and data will be highlighted and the wavelength (or time value) and photometric value at the cursor position can be read.
Press any key except for a cursor key ◁ ▷ and the [PRINT] key to make the cursor disappear. When Rec. mode is Overlay, the wavelength (or time value) and photometric value at the cursor position will be displayed for the most recently displayed curve.

### 2.3.15 Data Processing [DataProc]

Spectrum Measurement screen F2 key
Time scan Measurement screen F2 key
(only 1-cell measurement)

Data processing such as addition, subtraction, multiplication, division, differentiation, or area calculation, can be executed on the spectrum or time change curve measured with spectrum/time scan (only 1-cell measurement).

For detail of operation, see Chapter 11 "Data Processing Mode."

# Chapter 3 Photometric Mode

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# 3 Photometric Mode

This is the fixed wavelength measurement mode. This measures the absorbance (ABS) or % transmittance (T%) at a fixed wavelength.

By repeating a measurement, you can create and display a table of the measurement results.

It is also possible to quantitate the results by the K-factor method.

This is a simple quantitation method. A sample concentration C is expressed as C=K*ABS, and when the value for K (K = Conc. of Std / absorbance of Std) is already known, you can enter the value for K and measure the concentration of unknown samples.

Up to 166 data can be saved in one file.

# 3.1 Measurement Parameter Configuration Screen

When you select <1. Photometric> in the Mode Selection screen, the measurement parameter configuration screen will be displayed.

In this screen, measured values can be output in analog signal at fixed intervals by using the optional analog output interface. For the analog output interface, refer to the analog output interface manual.



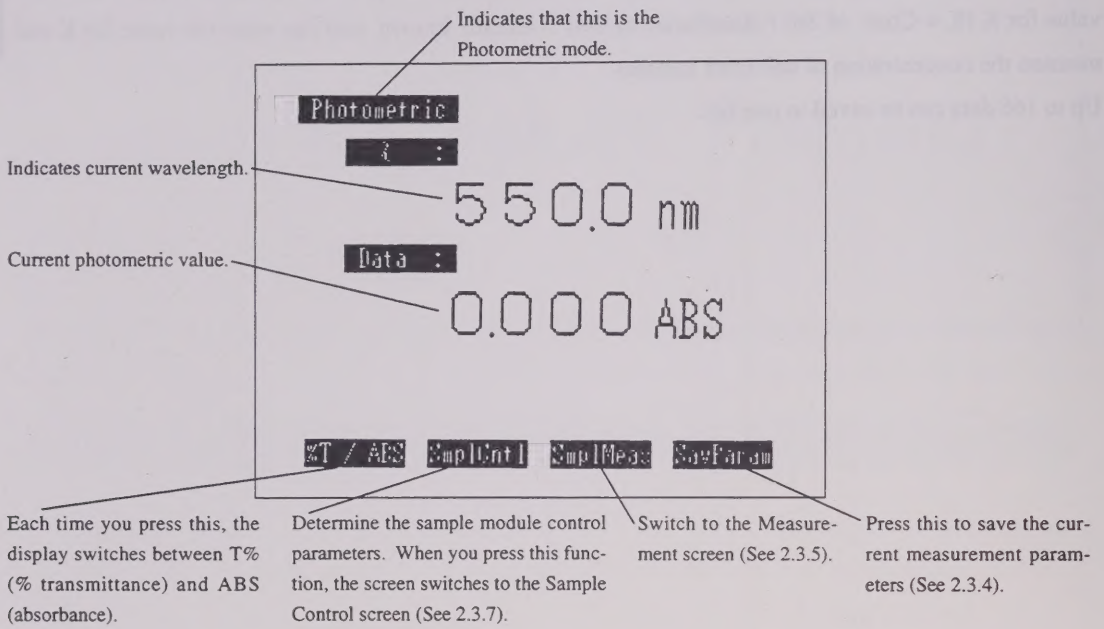
Indicates that this is the Photometric mode.
Photometric
λ :
Indicates current wavelength.
550.0 nm
Current photometric value.
Data :
0.000 ABS
%T / ABS
SmplCntl
SmplMeas
SavParam
Each time you press this, the display switches between T% (% transmittance) and ABS (absorbance).
Determine the sample module control parameters. When you press this function, the screen switches to the Sample Control screen (See 2.3.7).
Switch to the Measurement screen (See 2.3.5).
Press this to save the current measurement parameters (See 2.3.4).

**Fig. 3.1 Measurement parameter configuration screen**

# 3.2 Setting Measurement Parameters

### 3.2.1 Set Wavelength

Use the [GOTO WL] key to set the wavelength.

### 3.2.2 [T%/ABS]

You can switch between the % transmittance mode (T%) and absorbance mode (ABS) each time you press the [T%/ABS] key.

### 3.2.3 Sample Control [SmplCntl]

Set the type of sample module, the number of cells, the blank correction function, etc.

(See 2.3.7 Sample Control)

### 3.2.4 Save Parameters [SavParam]

You can save the current measurement parameters to internal memory or to a data pack (option).

(See 2.3.4 Save Parameters)

### 3.3.1 Measurement Screen [SmplMeas]

Determine the parameters and then press the [SmplMeas] or [START] key to switch to then measurement screen.

(At the same time that you press the [START] key, the first measurement will be performed.)

The method of assigning sample Nos. in the measurement screen in Figure 3.2 differs when a standard sample compartment, sipper 160 and syringe sipper (both options) are used, and when a multi-cell, micro multi-cell folder, and CPS-240 (all options) are used.



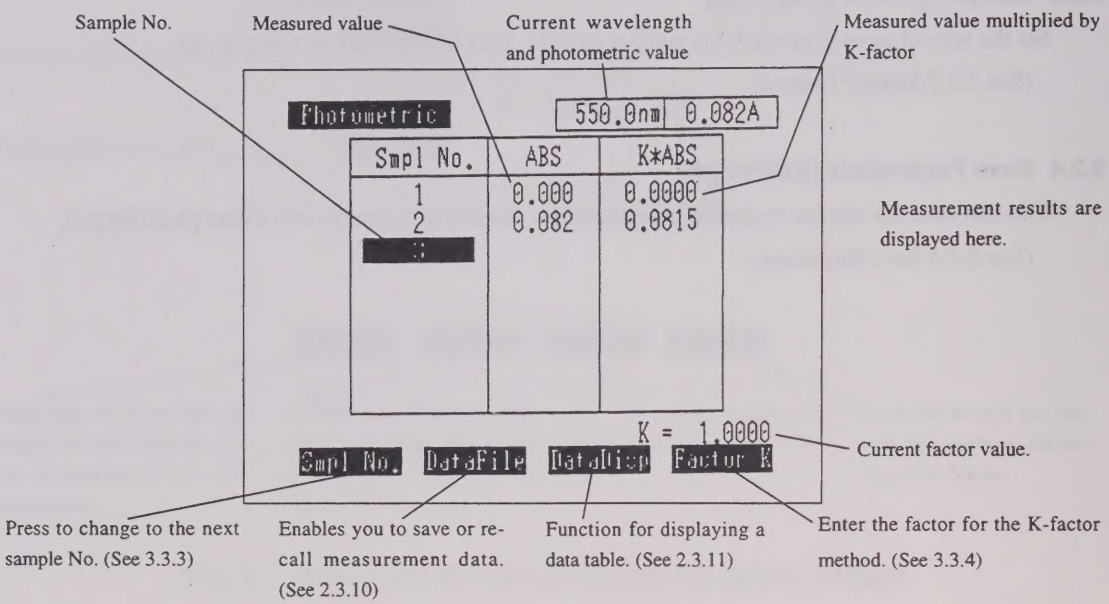


**Fig. 3.2(A) Photometric measurement screen (for standard cell holder or when only one cell is being used)**

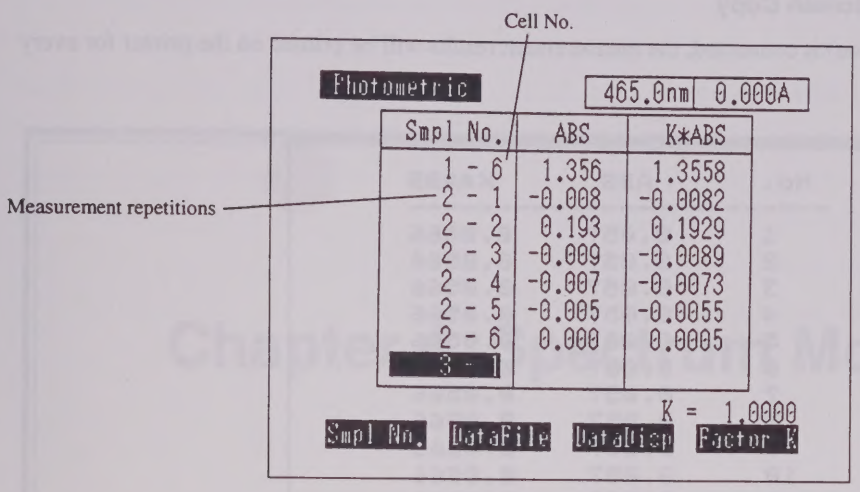


**Fig. 3.2(B) Photometric measurement screen**
**(when up to 6 cells are occupied when using a multi-cell, micro multi-cell, or CPS-240A)**

### 3.3.2 [AUTO ZERO]

When blank correction is necessary, set the blank sample and press then [AUTO ZERO] key before measurement Sets the photometric value at this time to 0ABS (100%).

### 3.3.3 Sample No. [Smpl No.]

You can reassign the number for the next sample being measured.
The sample number input range is 0 to 9999.

### 3.3.4 [Factor K] (Quantitation by K-factor method)

When the absorbance and concentration are directly proportional, this is a simple quantitation method that calculates the concentration by multiplying the absorbance by a certain conversion factor K.

In the measurement screen, select [Factor K] and then enter the value for K from the keyboard as instructed on the screen.

The current value for K is displayed in the lower-right of the screen. In addition, the value for factor * absorbance =K * ABS is displayed in the right-hand column of the table.

In the transmittance mode, the value for factor K*T% is displayed in the right-hand column of the table.

> NOTE! When performing quantitation by the K-factor method, it is suggested that the measurement mode be set to ABS (absorbance).

### 3.4.1 Data Print and Screen Copy

When a printer (option) is connected, the measurement results will be printed on the printer for every measurement.

| No. | ABS | K*ABS |
|---|---|---|
| 1 | 0.057 | 0.0566 |
| 2 | 0.057 | 0.0566 |
| 3 | 0.057 | 0.0566 |
| 4 | 0.057 | 0.0566 |
| 5 | 0.057 | 0.0566 |
| 6 | 0.057 | 0.0566 |
| 7 | 0.057 | 0.0566 |
| 8 | 0.057 | 0.0566 |
| 9 | 0.057 | 0.0566 |
| 10 | 0.057 | 0.0566 |
| 11 | 0.057 | 0.0566 |

**Fig. 3.3 Sample printout**

You can also print a hard copy of the current screen on the printer by pressing the [PRINT] key.

### 3.4.2 Data Management [DataFile]

This function is for saving the measurement data to memory, or calling up data to the screen.

(See 2.3.10 Data Management [DataFile])

### 3.4.3 Data Display [DataDisp]

This function is for displaying a list of measurement data, including data which has scrolled off the screen.

The data table can be printed or data can be deleted.

(See 2.3.11 Data Display [DataDisp])

# Chapter 4 Spectrum Mode



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# 4 Spectram Mode

This is the mode in which spectral measurement is performed.

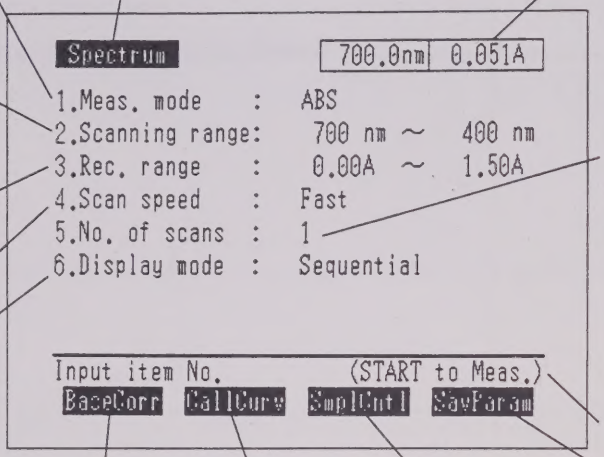
There are three types of measurement available: ABS (absorbance), T% (% transmittance) and single beam E (energy).

Measured spectra can be saved to memory and be subjected to various data processing in the Data Processing mode (Chapter 11).

# 4.1 Measurement Parameter Configuration Screen

When you select <2. Spectrum> in the Mode Selection screen, the measurement parameter configuration screen will be displayed.

The measurement parameter configuration screens differ slightly for the ABS (absorbance) and T% (% transmittance) measurement modes (Fig. 4.1) and for the E (energy) measurement mode (Fig. 4.2).


Spectrum
700.0nm 0.051A
1.Meas. mode : ABS
2.Scanning range: 700 nm ~ 400 nm
3.Rec. range : 0.00A ~ 1.50A
4.Scan speed : Fast
5.No. of scans : 1
6.Display mode : Sequential
Input item No. (START to Meas.)
BaseCorr CallCurv SmplCntl SavParam

Select absorbance (ABS), % transmittance (T%) or energy (E) measurement.

Shows that the instrument is in spectrum mode.

Shows the current wavelength and photometric value.

Shows the wavelength range over which the spectrum will be measured.

Shows the vertical axis range when a spectrum is displayed.

Shows the scan speed.

Shows how many times the spectrum will be measured for the same sample for each time the [START] key is pressed.

Select whether to overlay each spectrum on the same screen as they are measured or to renew the screen, deleting the previously acquired data each time a spectrum is measured.

Indicates the operating mode.

Perform baseline correction. (See 2.3.8)

Call up data stored in internal memory or a data pack. (See 2.3.9)

Set parameters for the sample module. (See 2.3.7)

Enables current measurement parameters to be saved. (See 2.3.4)

**Fig. 4.1 Measurement parameter configuration screen (ABS, T% modes)**

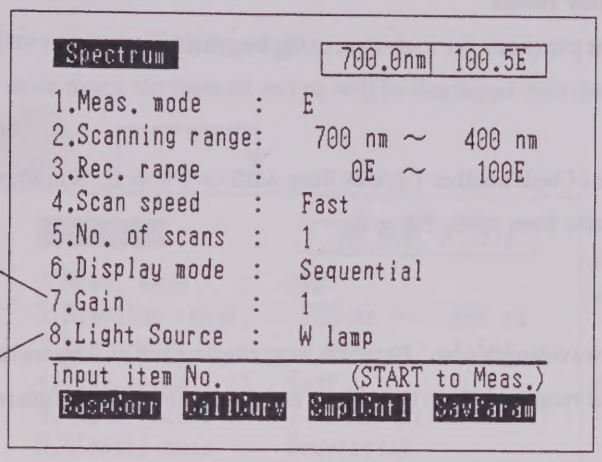

Spectrum
700.0nm 100.5E
1.Meas. mode : E
2.Scanning range: 700 nm ~ 400 nm
3.Rec. range : 0E ~ 100E
4.Scan speed : Fast
5.No. of scans : 1
6.Display mode : Sequential
7.Gain : 1
8.Light Source : W lamp
Input item No. (START to Meas.)
BaseCorr CalCurv SmplCntl SavParam
Set the gain for the photomeeter amplifier.
Set the light source to be used.

**Fig. 4.2 Measurement parameter configuration screen (E mode)**

### 4.2.1 Setting Parameter Items

Set the measurement parameter for each item using key dialogue.

<1. Meas. mode>

Successive selection of item number 1 cycles from ABS -> T% -> E. Simultaneously, the range in <3. Rec. range> also cycles from ABS, T% to E.



<2. Scanning range>

Set the range of the wavelength scan. Enter the scan starting and ending wavelength, in that order. The wavelength input range is 190nm to 1100nm and the starting wavelength must be the longer wavelength of the two.

The minimum scan range is 1nm.

(Scan start wavelength) - (Scan end wavelength) >= 1nm

<3. Rec. range>

Set the range for the vertical axis during spectrum recording. Input ranges

ABS : ±3.99A

T% : ±399%

E : ±399E

<4. Scan speed>

The following 5 wavelength scanning speed levels are available.

1. Very Fast
2. Fast
3. Medium
4. Slow
5. Very Slow

(See 4.5 Scanning Speed and Data Sampling Interval)

<5. No. of scans>

Set the number of times a scan will be repeated.

If this is set to 2 or more times, the interval setting will be displayed with the scanning repetitions on the same display line.

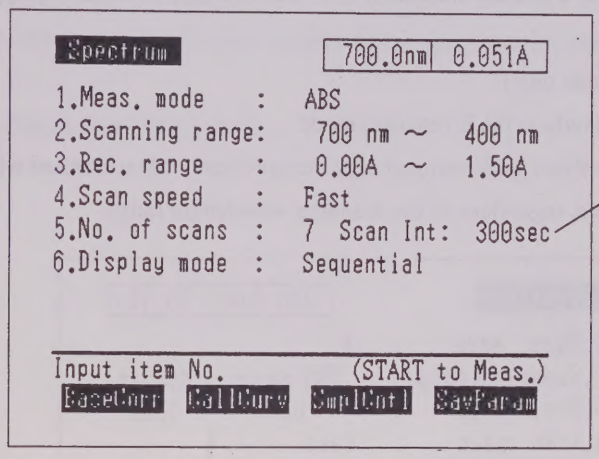

Spectrum
700.0nm 0.051A
1.Meas. mode : ABS
2.Scanning range: 700 nm ~ 400 nm
3.Rec. range : 0.00A ~ 1.50A
4.Scan speed : Fast
5.No. of scans : 7 Scan Int: 300sec
6.Display mode : Sequential
Input item No. (START to Meas.)
BaseCorr CalCurv SmplCnt SavParam
The scan interval will be displayed when the number of repetitions is set to 2 or more.

**Fig. 4.3 Parameter Configuration screen with scan interval displayed**

When you press the [START] key once, measurement will be repeated only the set number of times.

The scan interval is the time from the scan starting time to the next starting time.

If the time required for the actual scan is longer than the set time for the scan interval, the next scan will be performed without any wait time.

If the set scan interval time is longer than the time required for the actual scan, the next scan will start after waiting the amount of time equal to the difference between the two times. During the wait time, the number of remaining scan repetitions and the remaining wait time will be displayed.

<6. Display mode>

This parameter will toggle between Sequential<->Overlay each time this item is selected.

Sequential; The screen is renewed for each scan and only the spectrum from that measurement is displayed.

Overlay; The spectrum display for each scan is left as it is so that multiple spectra are overlaid in the display. If the No. of scans is set to 2 or more, each spectrum will be overlaid on the preceding spectra.

<7. Gain> (E mode only)

This will be displayed only in the E (energy) mode.

This sets the gain for the photometer amplifier so that measurement can be performed without saturation of the energy curve.

The minimum setting is 1 and the maximum is 4. Sensitivity is increased by approximately 4 times with each level.

<8. Light Source> (E mode only)

This will be displayed only in the E (energy) mode

Select the light source when performing energy measurement. Measurement will be performed using the selected light source, regardless of the scanning wavelength range.



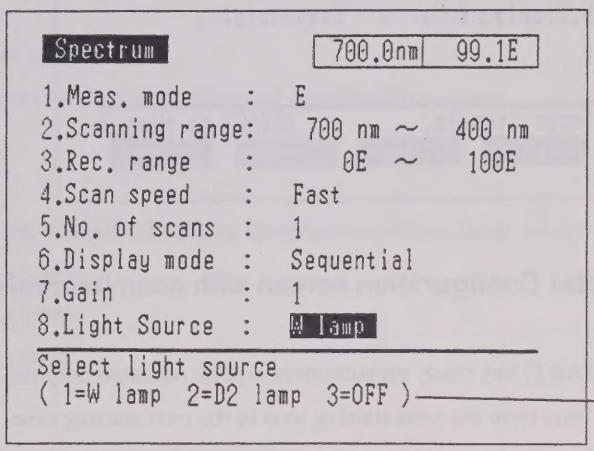

Spectrum
700.0nm
99.1E
1.Meas. mode : E
2.Scanning range: 700 nm ~ 400 nm
3.Rec. range : 0E ~ 100E
4.Scan speed : Fast
5.No. of scans : 1
6.Display mode : Sequential
7.Gain : 1
8.Light Source : W lamp
Select light source
( 1=W lamp 2=D2 lamp 3=OFF )
Select 1, 2 or 3.

**Fig. 4.4 Light source selection screen**

### 4.2.2 Baseline Correction [BaseCorr]

This allows you to set a blank sample and correct the baseline under the measurement parameters which have been set.

(See 2.3.8 Baseline Correction)

### 4.2.3 Call Curve [CallCurv]

This allows you to recall data which have been stored in the instrument memory or a data pack (option) to the screen.

(See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv])

### 4.2.4 Sample Control [SmplCntl]

Set the parameters such as sample module type.

(See 2.3.7 Sample Control [SmplCntl])

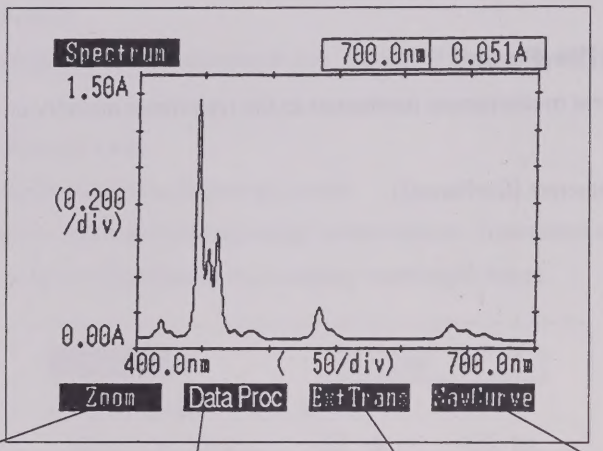
### 4.2.5 Save Parameters [SavParam]

You can save the current measurement parameters to the instrument memory or a data pack card (option).

(See 2.3.4 Save Parameters [SavParam])

# 4.3 Measurement

Once you have determined the parameters and press the [START] key, the display will switch to the measurement screen and measurement will begin. The measurement screen at the end of measurement be similar to that shown in Figure 4.5.




Enables you to change the ranges on the vertical and horizontal axes. (See 2.3.12)

Data processing for spectrum is possible. (See 2.3.15.)

Transmits the data to an external computer, etc. (See 2.3.13)

Enables you to save the spectrum to memory. (See 2.3.9)

**Fig. 4.5 Measurement screen**

Press the [START/STOP] key again to interrupt measurement.

The measurement results can be output to the printer (option) as a hard copy of the screen by pressing the [PRINT] key. When connected to a printer conforming to the ESC/P, it is possible not only to print a hard copy but to plot the spectrum in a half size of A4 paper. (Fig. 1.3)

# 4.4 Post-measurement Processing

After measurement is completed, you can perform the following types of data processing.

### 4.4.1 Cursor Functions

You can read the photometric value at any wavelength on the spectrum using the cursor.

(See 2.3.14 Cursor Functions)

### 4.4.2 Enlarge/Reduce [Zoom]

You can enlarge and reduce the spectrum by changing the ranges of the vertical and horizontal axes of the displayed spectrum.

(See 2.3.12 Enlarge/Reduce [Zoom])

### 4.4.3 Data Processing [DataProc]

Data processing such as differentiation, addition, subtraction, multiplication, division, or area calculation, can be executed on the spectrum measured with spectrum/time scan. See 2.3.15 "Data processing."

### 4.4.4 External Transmission [ExtTrans]

This enables you to transmit the spectrum data to an external computer, etc. from the RS-232C port.

(See 2.3.13 External Transmission [ExtTrans])

### 4.4.5 Save Curve [SavCurve]

This enables you to save the spectrum data to the instrument memory or a data pack (option).

(See 2.3.9 Save Curve [SavCurve])

# 4.5 Scanning Speed and Data Sampling Interval

The data sampling interval is determined by the set scanning speed and the scanning wavelength range. (Table 4.1)

**Table 4.1 Data Sampling Interval**

| Scanning range [ λ Range (nm)] (Start Wavelength - End Wavelength) | Scanning speed | |
|---|---|---|
| | Not Very Fast | Very Fast |
| 910nm ≧ range ≧ 500nm | 1.0nm | 2.0nm |
| 500nm > range ≧ 200nm | 0.5nm | 1.0nm |
| 200nm > range ≧ 100nm | 0.2nm | 0.5nm |
| 100nm > range | 0.1nm | 0.2nm |

# Chapter 5
# Quantitation Mode



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# 5 Quantitation Mode

This is the mode in which unknown samples are quantitated by creating a calibration curve from standard samples. The following 4 types of quantitation are available depending on the number of wavelengths used in the measurement method:

One-wavelength method

Two-wavelength method

Three-wavelength method

Derivative quantitation

The two/three-wavelength methods create the calibration curve and measure the unknown sample using several wavelengths. These are effective in eliminating the effects of dispersion due to interfering components and contaminants and in correcting "floating" of the baseline due to bubbles. For more details, see "5.6 Two/Three-wavelength Quantitation Method".

Derivative quantitation is a method of quantitation using the derivative of a spectrum. For more details, see "5.7 Derivative Quantitation Method".

The following 3 methods are available for creating calibration curves.

K-factor (C=K*ABS+B) method

Single point calibration curve method

Multi-point calibration curve method

The K-factor method is one in which you manually enter the factors K and B for the calibration curve.

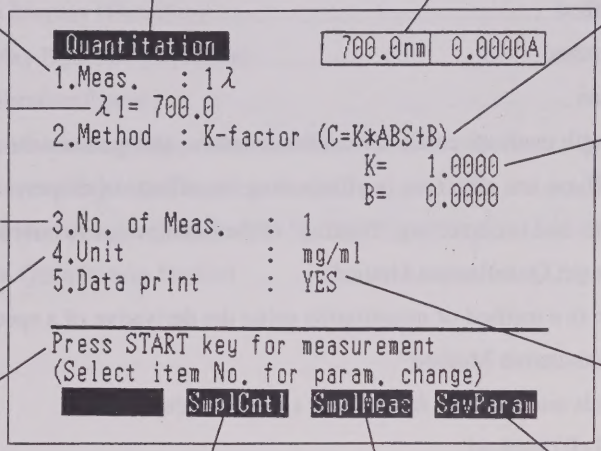
The Single point method is one in which the calibration curve is created by measuring a single standard sample.

The multi-point method is one in which the calibration curve is created by measuring multiple (up to 10) standard samples. The multi-point method will not only create a straight line, but can also generate 2nd and 3rd order curve fits of the data.

The quantitated data can be saved to memory or a data pack (option). Up to 182 data can be saved per file.

# 5.1 Measurement Parameter Configuration Screen

When you select <3. Quantitation> in the mode selection screen, the measurement parameters configuration screen in Figure 5.1 will be displayed.




Shows that the instrument is in the quantitation mode.

Shows the current wavelength and photometric value.

Shows which of the 4 measurement methods is being used.

Shows which of the 3 quantitation methods is being used.

Shows the wavelength being measured.

Shows the calibration curve factors, the concentration/absorbance of the standard sample, or the number of standard samples. The data displayed changes depending on the quantitation method used.

Shows the number of times a measurement will be repeated.

Shows the concentration units of the samples.

Shows whether or not the data will be printed for each measurement.

Shows if measurement is possible (calibration curve has been created) or if a calibration curve must be created.

Set the sample module parameters. (See 2.3.7)

Switch to the measurement screen. (See 2.3.5)

Save measurement parameters, including the calibration curve equation. (See 2.3.4)

**Fig. 5.1 Measurement parameter configuration screen**

# 5. 2 Setting Measurement Parameters

### 5.2.1 Set Parameters Items

Set the various measurement parameter items in a dialogue format. Select the parameter to be set by entering the item number.

<1. Meas.> (Measurement method)

The measurement method selection screen is shown in Figure 5.2.

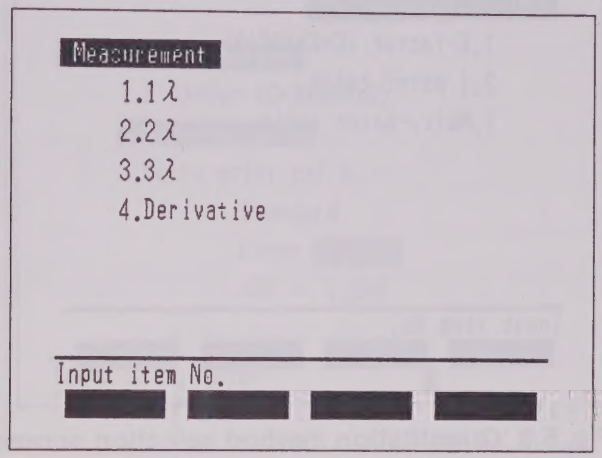



**Fig. 5.2 Measurement method selection screen**

Select the measurement method from the following 4 types and then enter the measurement wavelength as instructed on the screen.

Furthermore, if you select <4. Derivative>, enter the order of derivative (1st~4th).

<1. 1 λ >

Enter measurement wavelength $\lambda_1$.

<2. 2 λ >

Enter measurement wavelengths $\lambda_1$ and $\lambda_2$. $\lambda_1$ and $\lambda_2$ will be set in the order they were entered.

(See 5.6 Two/Three-wavelength Quantitation Method)

<3. 3 λ >

Enter measurement wavelengths $\lambda_1$, $\lambda_2$ and $\lambda_3$. $\lambda_1$, $\lambda_2$ and $\lambda_3$ will be sorted automatically in the order of $\lambda_1 > \lambda_2 > \lambda_3$ after they were entered.

(See 5.6 Two/Three-wavelength Quantitation Method)

<4. Derivative>

Enter the measurement wavelength $\lambda_1$ and the order of derivative.

(See 5.7 Derivative Quantitation Method)

<2. Method> (Quantitation method) ... (Create calibration curve)

The quantitation method can be selected from 3 methods, as shown in the screen in Figure 5.3. If you select single point calibration curve or multi-point calibration curve, create the calibration curve before measuring the unknown sample.

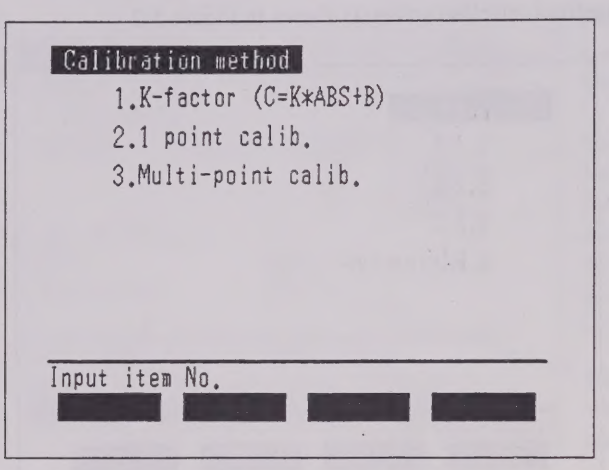



**Fig. 5.3 Quantitation method selection screen**



<1. K-factor (C=K*ABS+B)>

The relationship between the concentration C and absorbance ABS of a sample is expressed as C=K*ABS+B, and when the values for the constants K and B are already known, you can manually enter the values for K and B to create the calibration curve.

If you enter K and B, you can set a blank sample, press the [AUTO ZERO] key to set ABS=0 and immediately measure the blank sample.

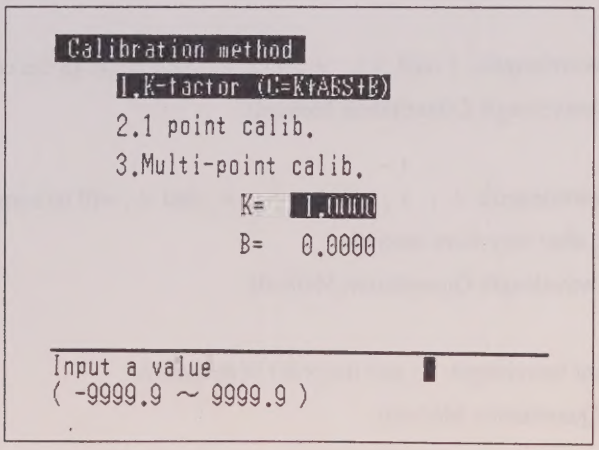



**Fig. 5.4 K/B input screen**

<2. Single point calib.>

This will measure the concentration of an unknown sample by finding the value for K in the calibration curve equation C=K*ABS from a single standard sample of known concentration. The calibration curve will be a straight line defined by the origin and the absorbance and concentration of the standard sample.

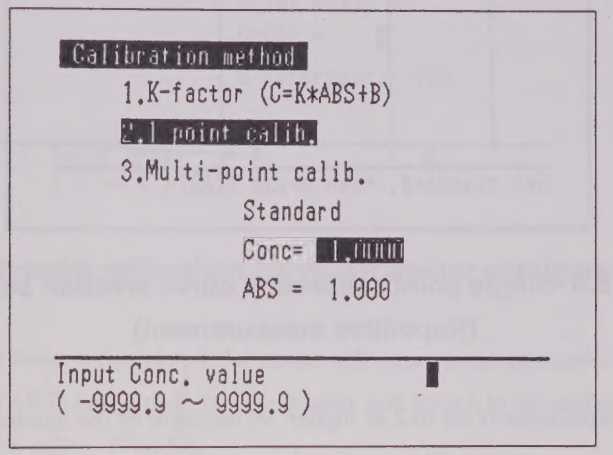



**Fig. 5.5 Single point calibration curve creation screen**

In order to create a calibration curve, first key in the concentration of the standard sample according to the instructions on the screen. Next, determine the value for ABS for the standard sample. (Fig. 5.5) There are two methods for entering the value for ABS, shown below.

1) Key input

   Enter the numeric value for ABS from the keyboard.

2) Measurement input (using only cell 1)

   Set the standard sample and press the [START] key.

   In the case of a multi-cell, micro multi-cell, or CPS-240 (all options), use only cell 1.

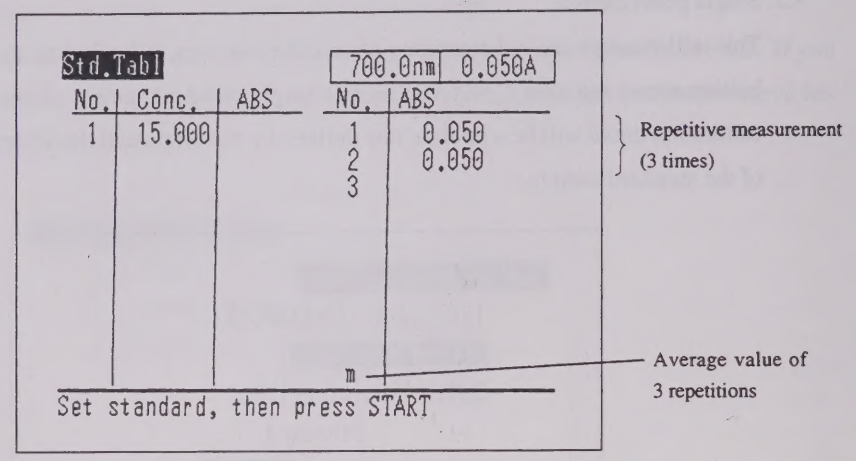



**Fig. 5.6 Single point calibration curve creation screen (Repetitive measurement)**

If the number of repetitions is set to 2 or higher, an indicator of the number of repetitions will be displayed and the average value will be used to determine the K value.

The results of each measurement will be displayed in the measurement value table on the right. After the repetitive measurements are completed, the average value (represented by m at the bottom of the right side) will be displayed in the concentration table on the left.

<3. Multi-point calib.>

1st/2nd/3rd order calibration curves can be created by the least square method from 1 to 10 standard samples of known concentrations.

Enter the number of standards samples (1-10), the order number (1-3) and whether or not to pass through the origin according to the instructions on the screen.

The number of standard samples must be more than the order number of the calibration curve when "0 intercept: YES" is selected, and must be more than (order number + 1) when "0 intercept: NO" is selected.

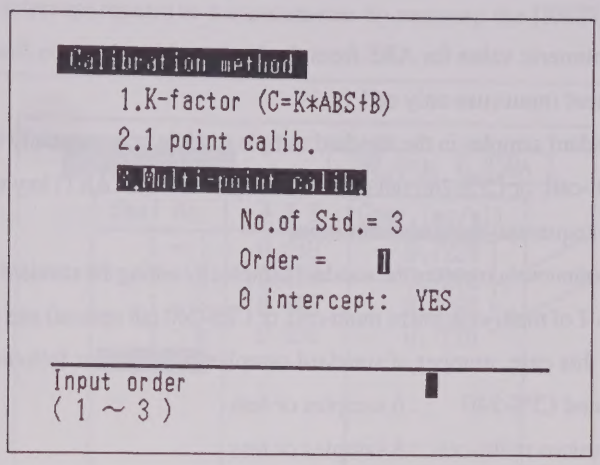



**Fig. 5.7 Multi-point calibration curve parameter configuration screen**

When setting of the items is completed, the screen will return to the parameter configuration screen. If you press the [START] key at this time, the display will switch to the calibration curve creation screen (concentration table). (Fig. 5.8)

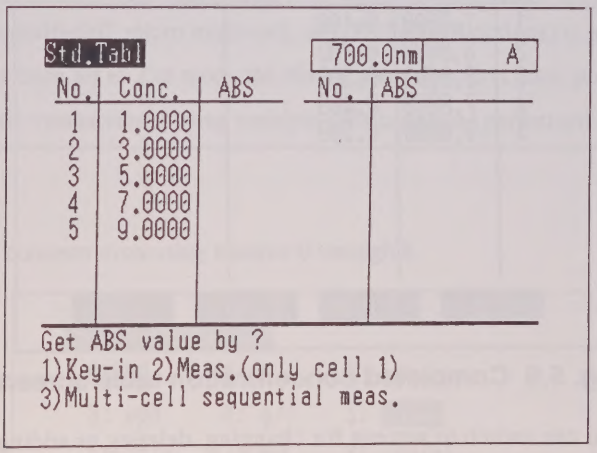



**Fig. 5.8 Multi-point calibration curve creation screen**

First, key in the concentration value for each standard sample (5 standard samples in the illustrated example) according to the instructions on the screen. The input order and the size of the concentration value are unrelated.

Next, enter the ABS value for each sample in order of the standard sample No. The following 3 input methods are available.

1) Key input

Enter the numeric value for ABS from the keyboard.

2) Measurement input (use only cell 1)

Set the standard samples in the standard sample module or sequentially in cell 1 of the multi-cell, micro multi-cell, or CPS-240 (all options) and press the [START] key to measure the sample.

3) Multi-cell sequential measurement input

You can continuously measure the standard samples by setting the standard sample sequentially from the cell No. 1 of multi-cell, micro multi-cell, or CPS-240 (all options) and pressing [START] key.

(In this case, number of standard samples should be as follows.)

Multi-cell and CPS-240 : 6 samples or less

8-position micro multi-cell : 8 samples or less

16-position micro multi-cell: 10 samples or less

Once you have completed entering the values for ABS, a table of concentrations and ABS (concentration table) will be created.

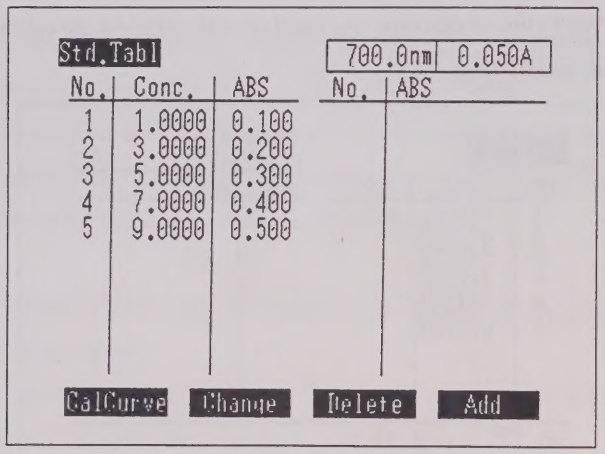



**Fig. 5.9 Completed concentration table screen**

In this screen, you can switch to screens for changing, deleting or adding standard sample data ([Change]/ [Delete]/[Add]) or for displaying the calibration curve ([CalCurve]).

(See 5.3 Calibration Curve Display and Modification)

<3. No. of Meas.> (Number of Measurements)

Determine how many times the same sample will be measured during measurement.

If this is set to 2 or more, the average value of the multiple measurements will be used as the ABS value for the standard sample when the calibration curve is created. When measuring an unknown sample , the measured value for each repetition and the average value will be displayed.

(See 5.4.1 Measurement Screen)

NOTE! If you interrupt repetitive measurements by pressing the [RETURN] key, the average value will not be computed.

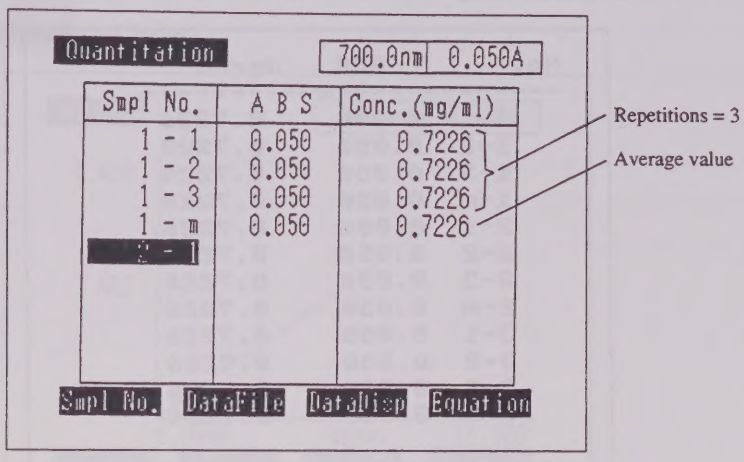



**Fig. 5.10 Sample data display screen (Unknown sample measurement screen)**

NOTE! When a multi-cell, micro multi-cell, or CPS-240 (all options) is used and the number of cells has been set to 2 or more, the No. of Meas. function takes precedence. In this case, automatic measurement using multiple cells cannot be performed.

<4. Unit>

Specify the unit of concentration using number 0 through 8.

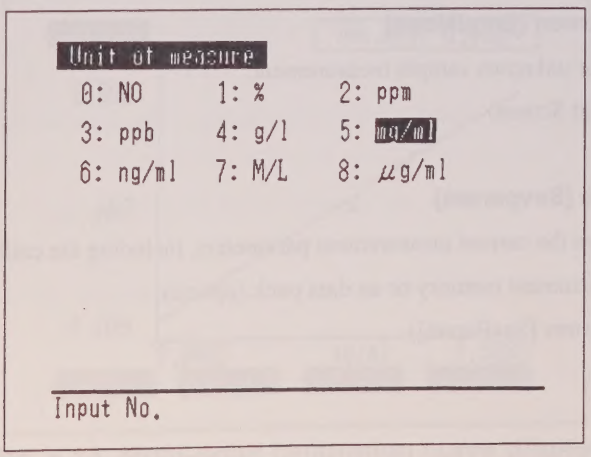



**Fig. 5.11 Unit input screen**

<5. Data print>

You can select whether or not to print the data for each measurement to the printer (option).

(See 5.4.1 Measurement Screen)

| No. | ABS | mg/ml |
|---|---|---|
| 1-1 | 0.050 | 0.7226 |
| 1-2 | 0.050 | 0.7208 |
| 1-3 | 0.050 | 0.7226 |
| 1-m | 0.050 | 0.7220 |
| 2-1 | 0.050 | 0.7226 |
| 2-2 | 0.050 | 0.7226 |
| 2-3 | 0.050 | 0.7226 |
| 2-m | 0.050 | 0.7226 |
| 3-1 | 0.050 | 0.7226 |
| 3-2 | 0.050 | 0.7226 |
| 3-3 | 0.050 | 0.7226 |
| 3-m | 0.050 | 0.7226 |

**Fig. 5.12 Sample printout**

When data print is set to "YES", the data for each unkown sample measurement will be printed to the printer.

### 5.2.2 Sample Control [SmplCntl]

Set the parameters such as the sample module being used, the number of cells, etc.

(See 2.3.7 Sample Control)

### 5.2.3 Measurement Screen [SmplMeas]

Switch to the screen for unknown sample measurement.

(See 2.3.5 Measurement Screen)

### 5.2.4 Save Parameters [Savparam]

This enables you to save the current measurement parameters, including the calibration curve which has been created, to the instrument memory or an data pack (option).

(See 2.3.4 Save Parameters [SavParam])

# 5.3 Calibration Curve Display and Modification

A single point or multi-point calibration curve which has been created can be displayed on the screen by selecting [CalCurve] in concentration table screen.

### 5.3.1 Single point Calibration Curve

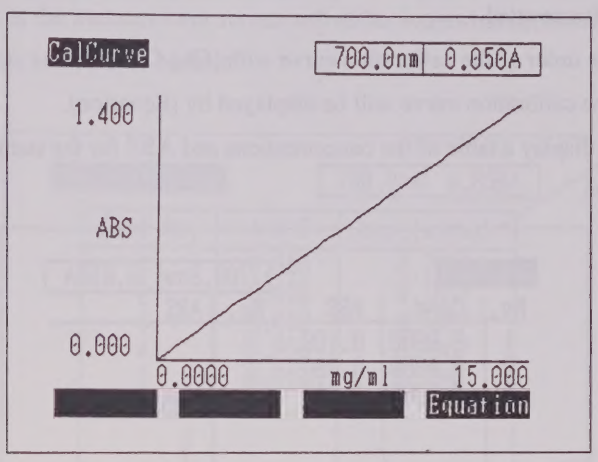



**Fig. 5.13 Single point calibration curve display**

The equation for the calibration curve will be displayed by selecting [Equation].

Calibration curve correction is performed by returning to the parameter configuration screen and selecting [CalCurve] again and then re-entering the standard sample data.

### 5.3.2 Multi-point Calibration Curve

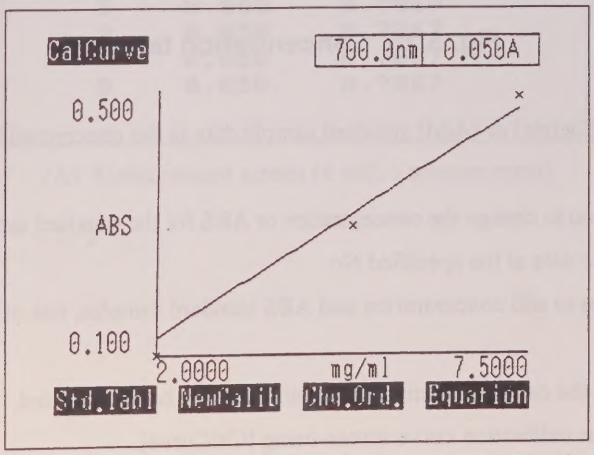



**Fig. 5.14 Multi-point calibration curve display**

The coordinate positions of each standard sample are shown by the x marks.

You can change the values for the concentration and ABS for all of the standard samples and create a new calibration curve using [NewCalib]. All standard sample data up to that point will be deleted when [NewCalib] is executed.

You can change the order of the calibration curve with [Chg.Ord.].

The equation for the calibration curve will be displayed by [Equation].

Press [Std.Tabl] to display a table of the concentrations and ABS for the standard samples (concentration table) on screen.



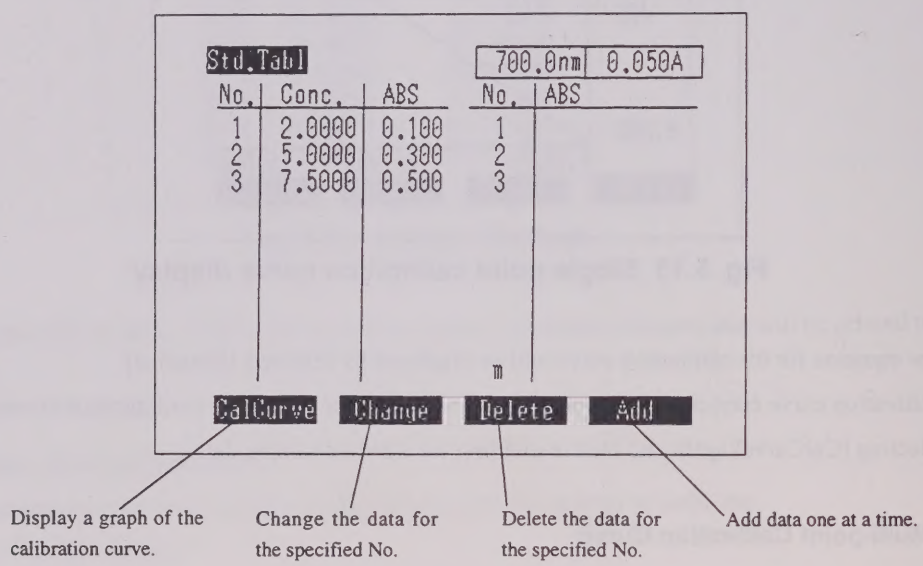



**Fig. 5.15 Concentration table**

You can [Change], [Delete] or [Add] standard sample data in the concentration table screen.

[Change] : Allows you to change the concentration or ABS for the standard sample at the specified No.

[Delete] : Deletes the data at the specified No.

[Add] : Allows you to add concentration and ABS standard samples, one at a time.

In all of these cases, the calibration curve will automatically be recalculated.

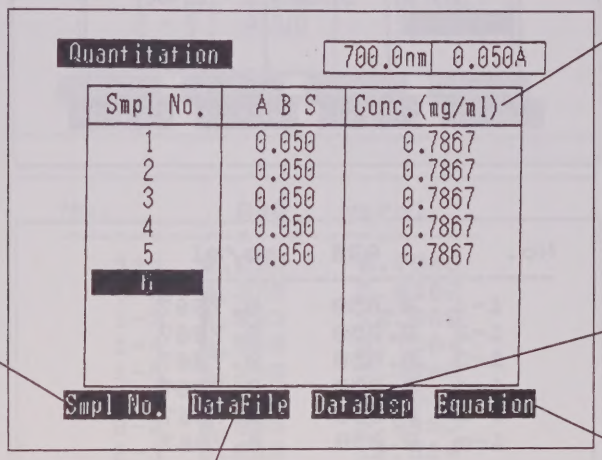
You can switch to the calibration curve screen using [CalCurve].

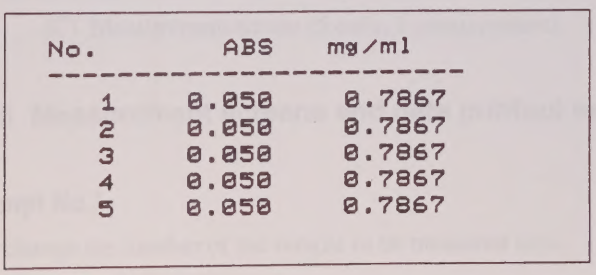
### 5.4.1 Measurement Screen

When creation of the calibration curve has been completed, you can switch to the measurement screen using the [SmplMeas] or the [START] key and perform measurements.

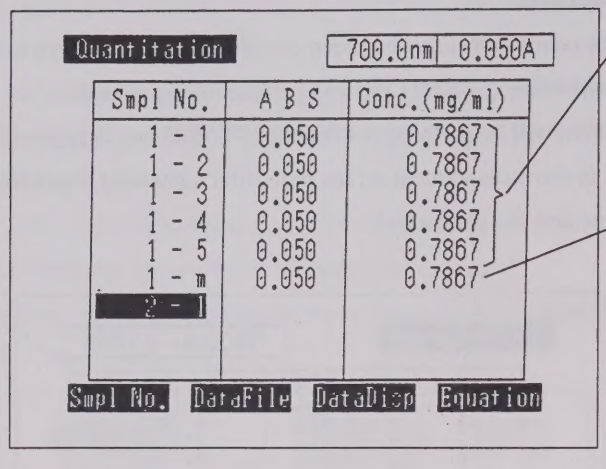
(The first measurement will be performed when the [START] key is pressed.)

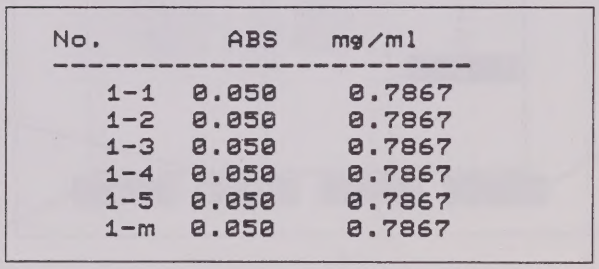
The display format in the measurement screen will differ somewhat depending on the settings for the No. of measurements and sample control.



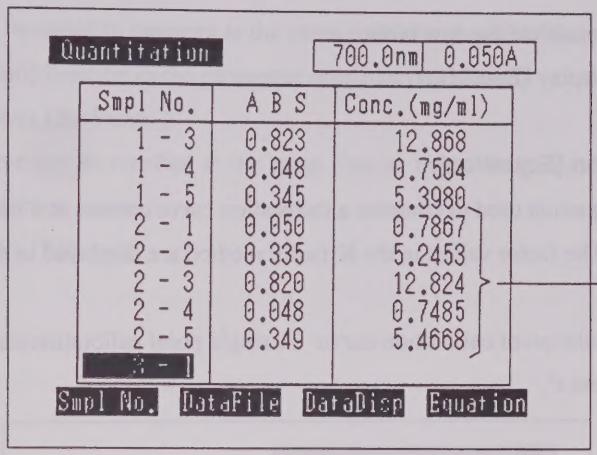



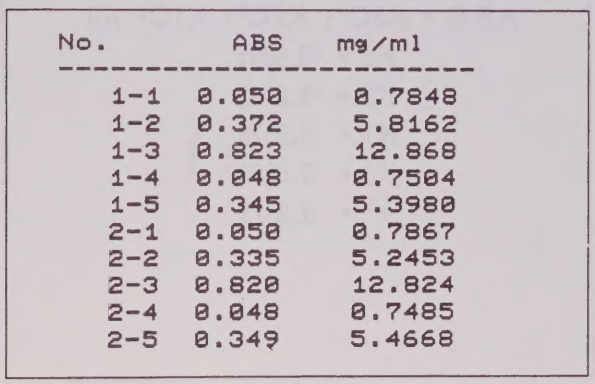

(A) Measurement screen (1 cell, 1 measurement)




(B) Measurement screen (1 cell, 5 measurements)


Quantitation
700.0nm 0.050A
Smpl No. | A B S | Conc.(mg/ml)
1 - 3 | 0.823 | 12.868
1 - 4 | 0.048 | 0.7504
1 - 5 | 0.345 | 5.3980
2 - 1 | 0.050 | 0.7867
2 - 2 | 0.335 | 5.2453
2 - 3 | 0.820 | 12.824
2 - 4 | 0.048 | 0.7485
2 - 5 | 0.349 | 5.4668
3 - 1
Smpl No.
DataFile
DataDisp
Equation
No. of measurements = 1
No. of cells = 5
Measurement data for cells 1 through 5




(C) Measurement screen (5 cells, 1 measurement)

**Fig. 5.16 Measurement screens and data printout examples**

### 5.4.2 Sample No. [Smpl No.]

This allows you to change the number of the sample to be measured next.

The sample No. input range is 0 to 9999.

### 5.4.3 Data Management [DataFile]

This function saves measurement data or recalls saved data to the screen.

(See 2.3.10 Data Management [DataFile])

### 5.4.4 Data Display [DataDisp]

This function displays a list of measurement data, including data which have been scrolled off the screen.

You can also print or delete the data table.

(See 2.3.11 Data Display [DataDisp])

### 5.4.5 Display Equation [Equation]

This displays the equation used to compute a calibration curve created as a single point or multi-point calibration curve. The factor values in the K-factor method are displayed in the parameter configuration screen.

An example of a multi-point calibration curve. A single point calibration curve will not display the correlation coefficient $r^2$.

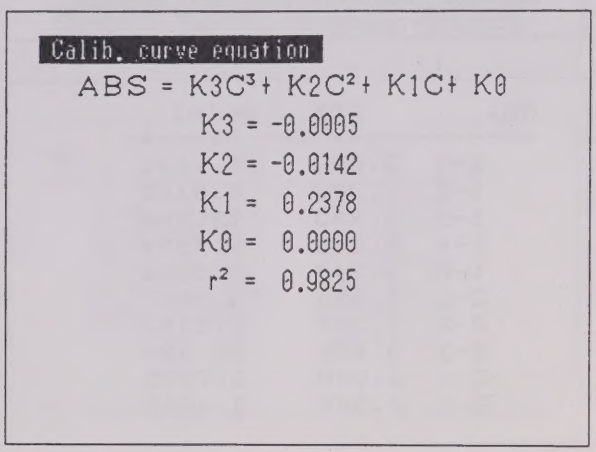



**Fig. 5.17 Sample calibration curve equation display**

# 5.5 Save Calibration Curve

A calibration curve can be saved to memory at the same time that the other measurement parameters are saved using the [SavParam] function in the parameter configuration screen.

(See 2.3.4 Save Parameters [SavParam])

A saved calibration curve can be recalled at the same time as the other measurement parameters using [Params] in the mode selection screen.

(See 2.3.1 Call Parameters [Params])

# 5.6 Two/Three-wavelength Quantitation Method

This is an accurate quantitation method which can be used to eliminate the effects of dispersion due to interfering components and contaminants and in correcting "floating" of the baseline due to bubbles when such conditions exist.

## 5.6.1 Two-wavelength Quantitation

This method quantitates based on the difference between the photometric values at two wavelengths. This allows for the elimination of the effects of interfering components.

Where $B_1$ and $B_2$ are the absorbances for the target component B at wavelengths $\lambda_1$ and $\lambda_2$, and $C_1$ and $C_2$ are the absorbances for the interfering component C ($A_1=B_1+C_1$, $A_2=B_2+C_2$), when wavelengths $\lambda_1$ and $\lambda_2$ are selected so that $C_1=C_2$, then $A_1-A_2=B_1-B_2$ so that only the information for the target compound is left. Normally, the absorbance wavelength for the target component is set for $\lambda_1$.

An example of two-wavelength measurement is shown in Figure 5.18.

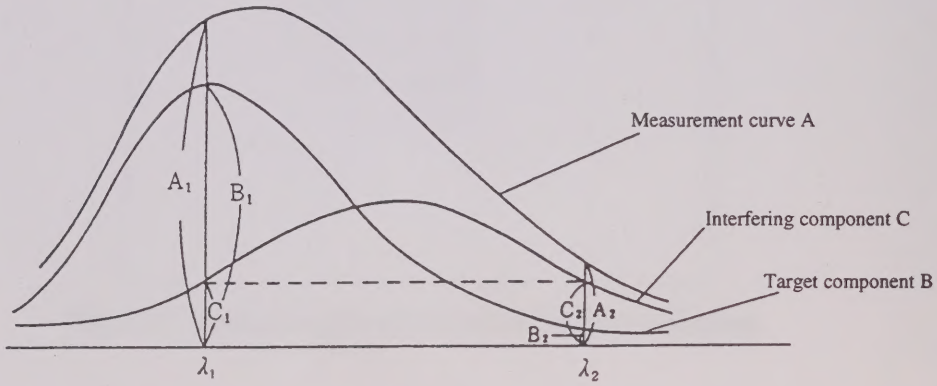



**Fig. 5.18 Schematic diagram of two-wavelength quantitation**

Quantitation measurement is then performed according to these parameters.

## 5.6.2 Three-wavelength Quantitation

The following calculation is performed based on the photometric values at three wavelengths.

$$A_2\text{-}A_4 \quad (\text{Where, } A_4=\frac{(\lambda_1-\lambda_2)A_3+(\lambda_2-\lambda_3)A_1}{\lambda_1-\lambda_3})$$

(See Fig. 5.19) Three-wavelength computation also eliminates the effects of interfering components, while also being useful in eliminating "floating" of sloped baselines due to dust, etc.

The elimination of the effects of an interfering component will be explained below using Figure 5.19.

If $\lambda_1$, $\lambda_2$ and $\lambda_3$ are taken so that the points S, T and U of the interfering component are connected by a single straight line, then $A_2$-$A_4$=$B_2$-$B_4$ leaving only the information for the target component. Normally, the absorbance wavelength for the target component is set for $\lambda_2$. Quantitation measurement is then performed according to these parameters.

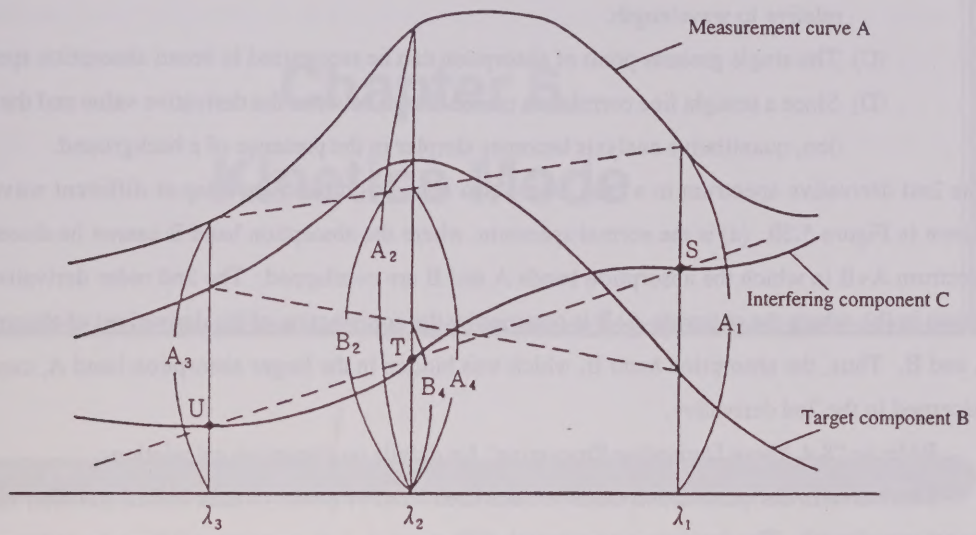



**Fig. 5.19 Schematic diagram of three-wavelength quantitation**

# 5.7 Derivative Quantitation Method

This method of quantitation uses the derivative value at a set wavelength(s). Derivative quantitation has the following advantages.

(A) Absorption bands can be recognized when there are two or more absorption bands overlapping at the same wavelength or at slightly different wavelengths.

(B) Weak absorption bands which are hidden in portions where the absorbance increases sharply relative to wavelength.

(C) The single greatest point of absorption can be recognized in broad absorption spectra.

(D) Since a straight line correlation can be drawn between the derivative value and the concentration, quantitative analysis becomes simpler in the presence of a background.



The 2nd derivative spectrum in a case where two absorption bands overlap at different wavelengths is shown in Figure 5.20. (a) is the normal spectrum, where the absorption band B cannot be discerned in the spectrum A+B in which the absorption bands A and B are overlapped. The 2nd order derivative of this is shown in (b), where the spectrum A+B is obtained by the combination of the derivatives of absorption bands A and B. Thus, the absorption band B, which was hidden in the larger absorption band A, can clearly be discerned in the 2nd derivative.

Refer to "8.4 About Derivative Processing" for details on derivative calculations.

Derivative in the quantitation mode is calculated from 17 points of data before and after the center of the set wavelength. The derivative wavelength difference $\Delta\lambda$ is constant at 0.8nm. In addition, the order of derivative can be set from 1st through 4th.

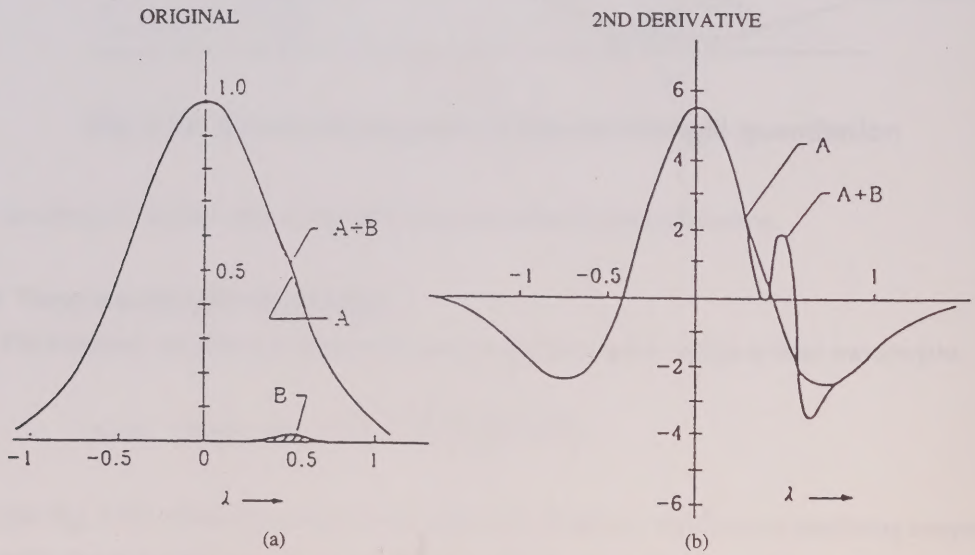



**Fig. 5.20 2nd derivative spectrum with two absorption bands - Overlapping at different wavelengths -**

# Chapter 6
# Kinetics Mode



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# 6 Kinetics Mode

In this mode, the time-dependent changes in absorbance or % transmittance at a fixed wavelength are measured and recorded. This mode includes an enzyme activity calculation function, a typical application of time change measurement.

This comprises finding the enzyme activity from the time changes in absorbance (enzyme reaction curve) caused as a result of enzymatic reactions.

The time changes in absorbance will be displayed on screen and the absorbance can be found at each sampling interval, set according to the (Lag time) + (Rate time) and amount of change in absorbance will be calculated Rate time.

The segment after measurement has started which is not subject to activity computation can be set as the "Lag time". The segment designated "Rate time" is evenly divided and the rate of change ( $\Delta$ Abs/min) is found for the rate time by the least square. The activity value is then found by multiplying this result by a factor.

The rate of change ( $\Delta$ Abs/min) can be recalculated for different segments by resetting the "Lag time" and "Rate time" for the same reaction curve.

# 6.1 Selecting the measurement method

When the 4. Kinetics is selected from the mode selection screen, the following measurement method selection screen will be displayed (Fig. 6.1.1).

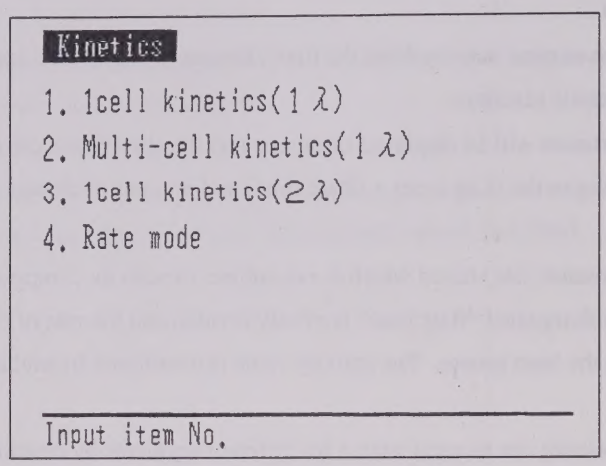


**Fig. 6.1.1 Measurement method selection screen**



Four kinds of measurement methods are contained in Kinetics mode. Each measurement method is as follows:

(1) 1 cell kinetics measurement (1 λ )

This is a mode for measuring enzyme activity value from the change in time of one wavelength absorbance.

(2) Multi-cell kinetics measurement (1 λ )

When used together with special accessories such as multi-cell, CPS-240 and micro multi-cell, this mode permits simultaneous measurement of the change in time of absorbance of up to a maximum of 16 cells to obtain enzyme activity values. This is the measurement of one wavelength.

(3) 1 cell kinetics measurement (2 λ )

In this mode, enzyme activity values are measured from the change in time of the difference of two wavelength absorbance.

(4) Rate measurement

In this mode, enzyme activity values are measured from the change in time of 1 cell absorbance just as (1). However, this mode is the successive display mode to display the change in successive absorbance in numerical values.

### 6.2.1 Operation

In the 1 cell kinetics measurement mode, it is possible to display the change in time of absorbance on the screen and obtain the change in absorbance quantity of an interval set by the lag time and rate time by calculating it is the change in quantity per minute.

Fig. 6.2.1 shows the relation between the change in time of absorbance and the lag time and rate time. Linear regression of the sampling data between the rate time is carried out by the method of least squares to obtain the rate of change (△ Abs/min).

Activity values are obtained by multiplying the range of change by four factor values.

(Activity value) = (Factor 1) × (Factor 2) × (Factor 3) × (Factor 4) × (Rate of change)

Activity values are displayed in the range from -9999.9 to 9999.9.

If this range is exceeded, ##### will be displayed. If the range is exceeded, change the set values of the factor and re-calculate them on the data table screen. If it is possible to predict the exceeded range, adjust the factor values and take the measurement again.

The initial value is the absorbance when measurement is started.

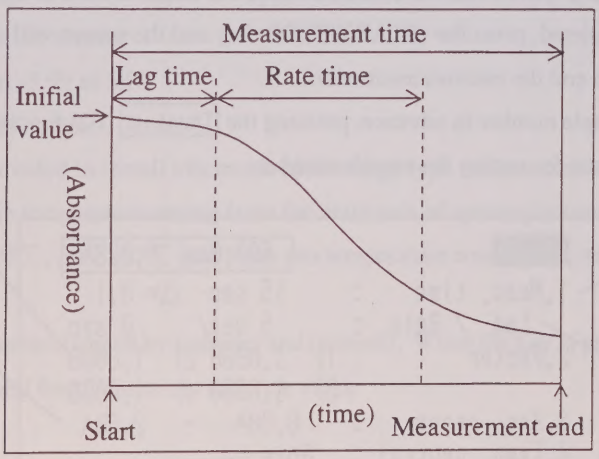


**Fig. 6.2.1 Lag time and rate time**

Data sampling intervals will be different depending on measurement time. (Table 6.2.1)

**Table 6.2.1 Measurement time and sampling intervals**

| Measurement time | Sampling interval |
|---|---|
| 1～ 100 | 0.1 |
| 101～ 200 | 0.2 |
| 201～ 500 | 0.5 |
| 501～1000 | 1.0 |
| 1001～2000 | 2.0 |
| 2001～5000 | 5.0 |
| 5001～6500 | 10.0 |



### 6.2.2 Setting measurement parameters

Parameters displayed on the Measurement Parameters screen can be changed by entering the number of the item using keys. Interactive method is the same as that of the main unit of spectrophotometer.

Fig. 6.2.2 shows the Parameters Setting screen for the 1 cell kinetics measurement. For setting the measurement wavelength, the (GOTO WL) key is used.

When setting is completed, press the (START/STOP) key and the screen will change to the Reaction Curve Display screen and the measurements start.

When setting the sample number in advance, pressing the DataList (F2) function key will display the screen in tabular format for setting the sample number.

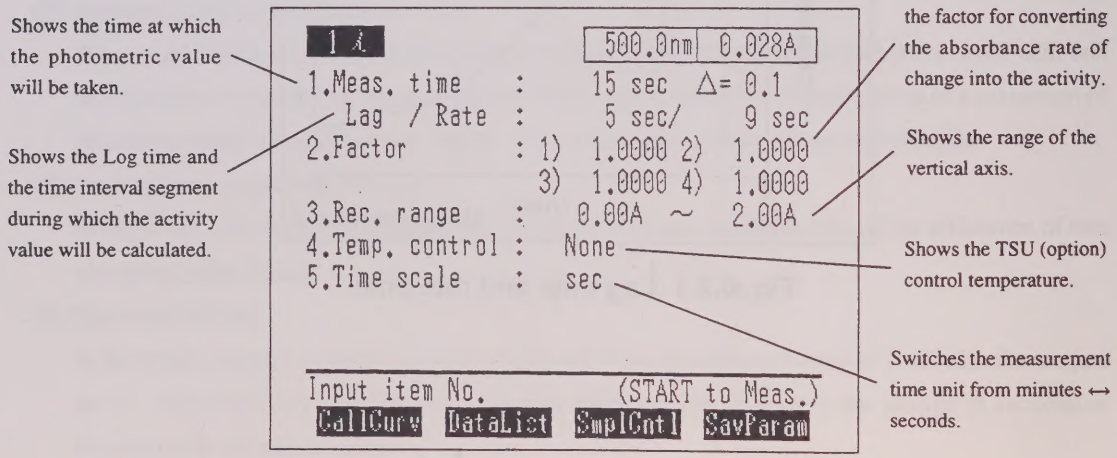
Shows the time at which the photometric value will be taken.
Shows the Log time and the time interval segment during which the activity value will be calculated.
1 λ
500.0nm 0.028A
1.Meas. time : 15 sec △= 0.1
Lag / Rate : 5 sec/ 9 sec
2.Factor : 1) 1.0000 2) 1.0000
3) 1.0000 4) 1.0000
3.Rec. range : 0.00A ～ 2.00A
4.Temp. control : None
5.Time scale : sec
Input item No. (START to Meas.)
CalCurv DataList SmplCntl SavParam
the factor for converting the absorbance rate of change into the activity.
Shows the range of the vertical axis.
Shows the TSU (option) control temperature.
Switches the measurement time unit from minutes ↔ seconds.

**Fig. 6.2.2 Parameters setting screen (1 cell kinetics (1 λ ))**

## Explanation of setting items

1. Measurement time and lag/rate

To set the measurement time, enter the total time to obtain actual absorbance data values. Lag indicates the lag time. After the measurement is started, an interval which is not used for activity value calculation is input by the time from when the measurement is started. Rate indicates the rate time and is used to input the time for activity value calculation immediately after the lag time. The time combining the lag and rate cannot exceed the measurement time.

(Measurement time) ≧ (Lag) + (Rate)

Input range is 1 to 6500 for the measurement time, 0 to 6490 for the lag, and 1 to (measurement time) - (lag) for the rate.

2. Factor

The factor is a coefficient used to connect the rate of change of absorbance in terms of the activity value. Four kinds of factors are set respectively. The relation between them is as follows:

(Activity value)= (Factor 1)×(Factor 2)×(Factor 3)×(Factor 4)×(Rate of change)

Input range is from -9999.9 to 9999.9.

3. Recording range

The recording range is used to input the upper limit/lower limit of the Y-axis when displaying the Reaction Curve on the screen.

Input range is from -3.99 to 3.99.

4. Sample temperature control

This is an item provided to install electronic cold energy type temperature control sipper TSU-2200 (optional) to enable temperature setting from the main unit of spectrophotometer.

Setting items are 25℃, 30℃, 37℃ and None (no temperature control), a total of four items.

5. Time unit

The unit of time can be changed by (minute) and (second). When the key is pressed, the unit of time of the item 1 is changed from min to sec and vice versa.

CallCurv

(F1): Pressing this function key enables to call on the screen the curve data stored in the memory of the main unit or the data pack (optional). When the reaction curve is recalled, the activity value is calculated by the factor value set on the parameters setting screen with respect to the recalled waveform data, and the results will be displayed.

DataList

(F2): When this function key is pressed, the Data Table screen will be displayed. Measurement results (sample number, initial value (ABS), △ A/min, activity value) will be tabulated. (See 6.6 Data list.)

SmplCntl

(F3): When this function key is pressed, the sample compartment to be used or parameters of the sample compartment will be set. (See 2.3.7 Sample Control [SmplCntl].)

SavParam

(F4): When this function key is pressed, it is possible to save the current measurement parameters in the memory of the main unit or the data pack (optional).

(See 2.3.4 Save Parameters [SavParam].)

### 6.2.3 Reaction curve

After measurement, measurement results are displayed in the data table and the screen will be changed to one showing the reaction curve. The dotted line as shown in Fig. 6.2.3 indicates the calculation interval of the activity value (the end of lag time and the end of rate time).

In this screen, pressing the cursor key (<,>) will display the cursor, and the time and absorbance of the cursor position can be read. Cursor can be moved by the cursor key.

When a printer (optional) is connected, measurement results displayed on the data table will be printed every time measurement is completed. Fig. 6.2.4 shows the example of printed measurement results.

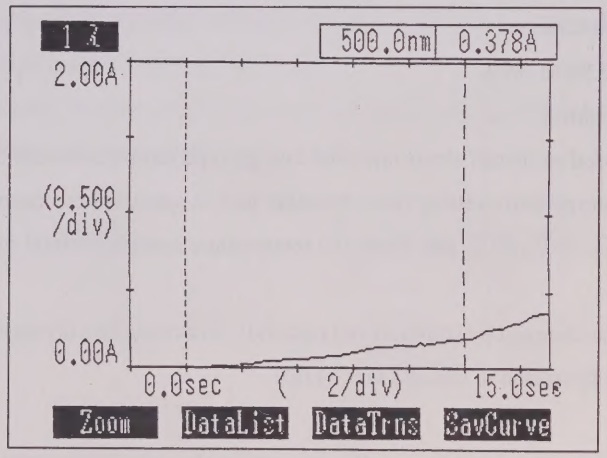


**Fig. 6.2.3 Reaction curve screen (1 cell kinetics (1 λ ))**

| No. | Init.ABS | dA/min | Activ. |
|---|---|---|---|
| 1 | 0.124 | 0.3187 | 0.6374 |
| 2 | 0.027 | 0.1870 | 0.3741 |
| 3 | 0.027 | 0.1870 | 0.3741 |
| 3-1 | 0.027 | 0.1781 | 0.3561 |

**Fig. 6.2.4 Example of printed measurement results (1 cell kinetics (1 λ))**

Zoom

(F1): Changing the range of Y-axis and X-axis of displayed reaction curve enables zooming of the reaction curve. After execution, this function returns to the [Restore] enables the status to return to one before zooming.

Data are available per sampling only. When a value of the X-axis (time axis) is input at a point other than the sampling point, the nearest sampling point including the input time is replaced with the input value of the X-axis and displayed. For sampling intervals, see Table 6.2.1.

DataList

(F2): Pressing this function key changes the screen to one showing the data table. Measurement results (sample number, initial value (ABS), ?? A/min, activity value) will be displayed in tabular format. (See 6.6 Data list.)

DataOutput

(F3): When this function key is pressed, the time and absorbance value per sampling point of reaction curve will be output on the printer (optional) or the RS-232C port. (See 6.2.4 Data Output.)

SavCurv

(F4): When this function key is pressed, it is possible to save the reaction curve in the memory of the main unit or the data pack (optional). It is also possible to recall the reaction curve. When the reaction curve is recalled, the activity value is calculated by the factor value set in the Parameters Setting screen with respect to the recalled waveform data and the results will be displayed.

### 6.2.4 Data output

With this function key, it is possible to output the time and absorbance value per sampling point of reaction curve will be output on the printer (optional) or the RS-232C port.

An example of output to the printer of the format 1 is shown in Fig. 6.2.5. The same display of character-string will also be output simultaneously on the RS-232C port.

The format 2 (RS-232C) will not be outputted to the printer. Time and absorbance will be output in pairs to the RS-232C port excepting the header and data number of the format 1.

| No. | Time(sec) | ABS |
|---|---|---|
| 1 | 0.0 | 0.027 |
| 2 | 0.1 | 0.027 |
| 3 | 0.2 | 0.027 |
| 4 | 0.3 | 0.027 |
| 5 | 0.4 | 0.027 |
| 6 | 0.5 | 0.027 |
| 7 | 0.6 | 0.027 |
| 8 | 0.7 | 0.027 |
| 9 | 0.8 | 0.028 |
| 10 | 0.9 | 0.028 |
| 11 | 1.0 | 0.028 |
| 12 | 1.1 | 0.028 |
| 13 | 1.2 | 0.027 |
| 14 | 1.3 | 0.027 |
| 15 | 1.4 | 0.027 |
| 16 | 1.5 | 0.027 |
| 17 | 1.6 | 0.028 |
| 18 | 1.7 | 0.028 |
| 19 | 1.8 | 0.028 |
| 20 | 1.9 | 0.028 |
| 21 | 2.0 | 0.029 |

**Fig. 6.2.5 Example of printed output format 1 (1 cell kinetics (1 λ))**

# 6.3 Multi-cell kinetics measurement (1 λ)

## 6.3.1 Operation

In the multi-cell kinetics measurement mode, multi-cell (optional), micro multi-cell (optional) and CPS-240 (optional) are used to measure simultaneously the change in time of absorbance of a plurality of samples and to display the results on the screen.

Obtain the change in absorbance of an interval set by lag time and rate time by calculating it in terms of the change in quantity per minute. The method for obtaining the rate of change and that for calculation of activity value are the same as those of the 1 cell kinetics.

Unlike the case of using one sample, when the measurement time is set, the number of measurements and cycle will be displayed. The number of measurements is used to set the number of measurements with respect to one sample, and the cycle is the time from when one sampling of each sample is completed to the next sampling. In other words, it is expressed as follows:

(Measurement time) = (Cycle) × {(No. of measurements) - 1}

Activity value is displayed in a range from -9999.9 to 9999.9. If this range is exceeded, ##### will be displayed. If this range is exceeded, change the factor set value and re-calculate on the screen of data table. When it is possible to predict that the range will be exceeded, adjust the factor value and measure the activity value.

In the case of multi-cell kinetics, the initial value is the absorbance when the sampling is carried out first in each cell after starting measurements.

## 6.3.2 Setting measurement parameters

Parameters displayed on the Measurement Parameters screen can be changed by inputting the number of the item using keys. The interactive method is the same as that the main unit of spectrophotometer. Fig. 6.3.1 shows the Parameters Setting screen of the multi-cell kinetics measurement. For setting the measurement wavelength, the (GOTO WL) key is used.

After setting, pressing the (START/STOP) key changes the screen to one showing the reaction curve, and measurements will start.

When setting the sample number in advance, press the DataList (F2) function key and set data on the screen of data table.

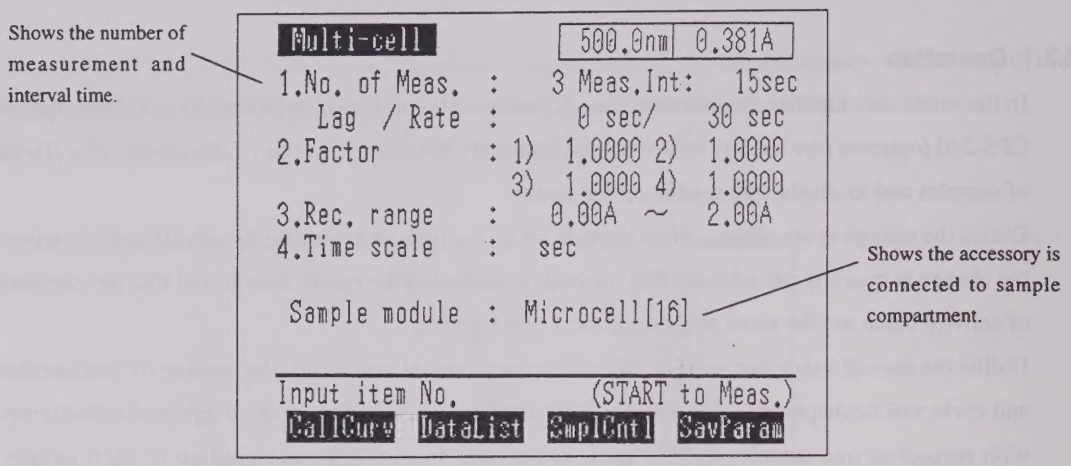
Shows the number of measurement and interval time.
Multi-cell
500.0nm 0.381A
1.No. of Meas. : 3 Meas.Int: 15sec
Lag / Rate : 0 sec/ 30 sec
2.Factor : 1) 1.0000 2) 1.0000
3) 1.0000 4) 1.0000
3.Rec. range : 0.00A ~ 2.00A
4.Time scale : sec
Sample module : Microcell[16]
Shows the accessory is connected to sample compartment.
Input item No. (START to Meas.)
CalCurv DataList SmplCnt1 SavParam

**Fig. 6.3.1 Parameters setting screen (Multi-cell kinetics (1 λ))**



## Explanation of setting items

1. No. of measurements, cycle and lag/rate

The number of measurements is used to set the number of measurements to be made with respect to one sample. The input range is from 2 to 60.

The cycle is the time from when one sampling of each sample is completed to the next sampling. If the unit is sec, the lower limit of the input range is determined based on the cell holder and the number of cells to be used. (Table 6.3.1) The upper limit of the input range is determined by the set number of measurements. The upper limit value is set so that the time value determined by cycle ×(No. of measurements - 1) is less than 6553.

Lag indicates the lag time. After the measurement is started, an interval which is not used for activity value calculation is input by the time from when the measurement is started. Rate indicates the rate time and is used to input the time for activity value calculation immediately after the lag time. The input range of lag and rate is different from that of the one wavelength kinetics. Since at least two samplings (one cycle) are necessary for calculation of the rate of change, the upper limit of lag will be the value subtracted of such sampling. Therefore, the input range of lag is from 0 to {cycle×(No. of measurements - 1) - cycle}. When the lag is 0, the lower limit of rate is one cycle, and except when the lag is not 0, the lower limit of rate will be (Cycle)×2 - (Lag). Since the upper limit is the time where the lag is subtracted from the total measurement time, it will be (Cycle)×(No. of measurements - 1) - (Lag).

2. Factor

The factor is a coefficient used to connect the rate of change of absorbance in terms of the activity value. Four kinds of factors are set respectively. The relation between them is as follows:

(Activity value)= (Factor 1)×(Factor 2)×(Factor 3)×(Factor 4)×(Rate of change)

Input range is from -9999.9 to 9999.9.

3. Recording range

The recording range is used to input the upper limit/lower limit of the Y-axis when displaying the Reaction Curve on the screen.

Input range is from -3.99 to 3.99.

4. Time unit

The unit of time can be changed by (minute) and (second). When the key is pressed, the unit of time of the item 1 is changed from min to sec and vice versa.

CallCurv

(F1): Pressing this function key enables to call on the screen the curve data stored in the memory of the main unit or the data pack (optional). When the reaction curve is recalled, the activity value is calculated by the factor value set on the parameters setting screen with respect to the recalled waveform data, and the results will be displayed.

DataList

(F2): When this function key is pressed, the Data Table screen will be displayed. Measurement results (sample number, initial value (ABS), △ A/min, activity value) will be tabulated.

(See 6.6 Data list.)

SmplCntl

(F3): When this function key is pressed, the sample compartment to be used or parameters of the sample compartment will be set. (See 2.3.7 Sample Control SmplCntl)

SavParam

(F4): When this function key is pressed, it is possible to save the current measurement parameters in the memory of the main unit or the data pack (optional).

**Table 6.3.1 Minimum cycle (sec)**

| No. of cells | Multi-cell | CPS-240 | 8 series micro cell | 16 series micro cell |
|---|---|---|---|---|
| 2 | 4 | 4 | 5 | 4 |
| 3 | 5 | 6 | 8 | 6 |
| 4 | 7 | 8 | 11 | 8 |
| 5 | 9 | 10 | 14 | 10 |
| 6 | 11 | 12 | 17 | 12 |
| 7 | - | - | 20 | 13 |
| 8 | - | - | 22 | 15 |
| 9 | - | - | - | 17 |
| 10 | - | - | - | 19 |
| 11 | - | - | - | 21 |
| 12 | - | - | - | 23 |
| 13 | - | - | - | 25 |
| 14 | - | - | - | 27 |
| 15 | - | - | - | 29 |
| 16 | - | - | - | 30 |



### 6.3.3 Reaction curve

After the measurement is completed, measurement results will be displayed on the data table and the screen will be changed to one showing the reaction curve. (Fig. 6.3.2) The dotted line in the display screen indicates the calculation interval (the end of lag time and the end of rate time) of the activity value. × indicates the sampling point.

When a printer is connected, measurement results will be printed on the data table every time the measurement is completed. Fig. 6.3.3 shows a printed example.

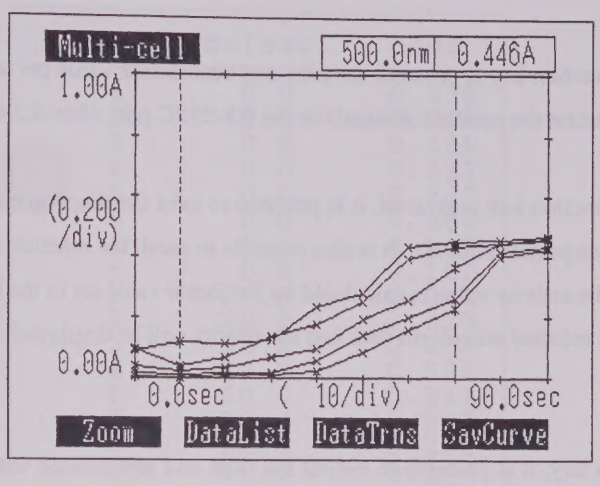


**Fig. 6.3.2 Reaction curve screen (Multi-cell kinetics (1 λ ))**

| No. | Init.ABS | dA/min | Activ. |
|---|---|---|---|
| 1 | 0.939 | 0.0695 | 0.0695 |
| 2 | 0.658 | 0.0445 | 0.0445 |
| 3 | 0.469 | 0.0190 | 0.0190 |
| 4 | 0.327 | 0.0162 | 0.0162 |
| 5 | 0.237 | 0.0112 | 0.0112 |
| 6 | 0.204 | 0.0089 | 0.0089 |
| 7 | 0.255 | 0.0097 | 0.0097 |
| 8 | 0.162 | 0.0059 | 0.0059 |

**Fig. 6.3.3 Example of printed measurement results (Multi-cell kinetics (1 λ ))**

Zoom

(F1): Changing the range of Y-axis and X-axis of displayed reaction curve enables zooming of the reaction curve. After execution, this function returns to the [Restore] enables the status to return to one before zooming.

Data are available per sampling only. When a value of the X-axis (time axis) is input at a point other than the sampling point, the nearest sampling point including the input time is replaced with the input value of the X-axis and displayed.

DataList

(F2): Pressing this function key changes the screen to one showing the data table. Measurement results (sample number, initial value (ABS), △ A/min, activity value) will be displayed in tabular format. (See 6.6 Data list.)

DataOutput

(F3): When this function key is pressed, the time and absorbance value per sampling point of reaction curve will be output on the printer (optional) or the RS-232C port. (See 6.3.4. Data Output.)

SavCurv

(F4): When this function key is pressed, it is possible to save the reaction curve in the memory of the main unit or the data pack (optional). It is also possible to recall the reaction curve. When the reaction curve is recalled, the activity value is calculated by the factor value set in the Parameters Setting screen with respect to the recalled waveform data and the results will be displayed.

### 6.3.4 Data output

With this function key, it is possible to output the time and absorbance value per sampling point of reaction curve will be output on the printer (optional) or the RS-232C port.

An example of output to the printer of the format 1 is shown in Fig. 6.3.4. The same display of character-string will also be output simultaneously on the RS-232C port.

An example of output to the printer of the format 2 is shown in Fig. 6.3.5. The same display of character-string will also be output simultaneously on the RS-232C port.

The format 3 (RS-232C) will not be output to the printer. The time, cell value and absorbance will be output to the RS-232C in that order, excepting the header of the format 1.

The format 4 (RS-2332C) will not be output to the printer. The cell time, time and absorbance will be output to the RS-232C in that order, excepting the header of the format 2.

| Time(sec) | Cell | ABS |
|---|---|---|
| 0.0 | 1 | 0.939 |
| 20.0 | 1 | 0.962 |
| 40.0 | 1 | 0.985 |
| 0.0 | 2 | 0.658 |
| 20.0 | 2 | 0.673 |
| 40.0 | 2 | 0.688 |
| 0.0 | 3 | 0.469 |
| 20.0 | 3 | 0.466 |
| 40.0 | 3 | 0.475 |
| 0.0 | 4 | 0.327 |
| 20.0 | 4 | 0.332 |
| 40.0 | 4 | 0.338 |
| 0.0 | 5 | 0.237 |
| 20.0 | 5 | 0.241 |
| 40.0 | 5 | 0.245 |
| 0.0 | 6 | 0.204 |
| 20.0 | 6 | 0.207 |
| 40.0 | 6 | 0.210 |
| 0.0 | 7 | 0.255 |
| 20.0 | 7 | 0.258 |
| 40.0 | 7 | 0.261 |
| 0.0 | 8 | 0.162 |
| 20.0 | 8 | 0.164 |
| 40.0 | 8 | 0.166 |

**Fig. 6.3.4 Example of printed Data Output format 1 (Multi-cell kinetics (1 λ ))**

| Cell | Time(sec) | ABS |
|---|---|---|
| 1 | 0.0 | 0.939 |
| 2 | 0.0 | 0.658 |
| 3 | 0.0 | 0.469 |
| 4 | 0.0 | 0.327 |
| 5 | 0.0 | 0.237 |
| 6 | 0.0 | 0.204 |
| 7 | 0.0 | 0.255 |
| 8 | 0.0 | 0.162 |
| 1 | 20.0 | 0.962 |
| 2 | 20.0 | 0.673 |
| 3 | 20.0 | 0.466 |
| 4 | 20.0 | 0.332 |
| 5 | 20.0 | 0.241 |
| 6 | 20.0 | 0.207 |
| 7 | 20.0 | 0.258 |
| 8 | 20.0 | 0.164 |
| 1 | 40.0 | 0.985 |
| 2 | 40.0 | 0.688 |
| 3 | 40.0 | 0.475 |
| 4 | 40.0 | 0.338 |
| 5 | 40.0 | 0.245 |
| 6 | 40.0 | 0.210 |
| 7 | 40.0 | 0.261 |
| 8 | 40.0 | 0.166 |

**Fig. 6.3.5 Example of printed Data Output format 2 (Multi-cell kinetics (1 λ ))**

# 6.4 1 cell kinetics measurement (2 λ )

## 6.4.1 Operation

1 cell kinetics measurement (2 λ ) mode is used to measure the change in time of the difference in two wavelength absorbance and to obtain the change in quantity of the difference in absorbance of an interval set by the lag time and rate time by calculating it in terms of the change in quantity per minute. The method for obtaining the rate of change and that for calculation of activity value is the same as those of the one wavelength kinetics.

Unlike the case of using one wavelength, when the measurement time is set, the number of measurements and cycles will be displayed.

The number of measurements is used to set the number of measurements of the absorbance difference. The cycle is the time from when one sampling of each sample is completed to the next sampling. In other words, it will be as follows:

(Measurement time) = (Cycle)×{(No. of measurements) - 1}

Absorbance difference is the value where the absorbance of λ 2 is subtracted from the absorbance of λ 1.

The display range of activity value is from -9999.9 to 9999.9. If the display range is exceeded, ##### will be displayed. When the display range is exceeded, change the factor set value and re-calculate the activity value in the data table screen. When it possible to predict in advance that the range will be exceeded, adjust the factor value and measure the activity value again.

In the case of the 1 cell kinetics (2 λ ), the initial value is the difference of the two wavelength absorbance which is sampled first.

## 6.4.2 Setting measurement parameters

Parameters displayed on the Measurement Parameters screen can be changed by entering the number of the item. Interactive method is the same as that of the main unit of spectrophotometer. Fig. 6.4.1 shows the Parameters Setting screen for the 1 cell kinetics measurement (2 λ ).

When setting is completed, press the (START/STOP) key and the screen will change to on showing the reaction curve and the measurements start.

When setting the sample number in advance, pressing the [DataList] (F2) function key will display the data table screen for setting the sample number.

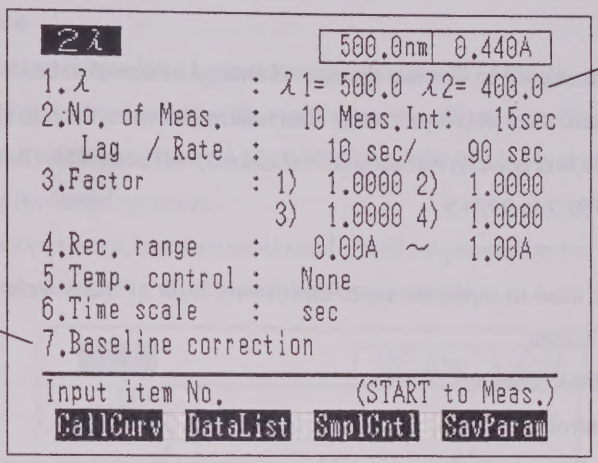
2λ
500.0nm 0.440A
1.λ : λ1= 500.0 λ2= 400.0
2.No. of Meas. : 10 Meas.Int: 15sec
Lag / Rate : 10 sec/ 90 sec
3.Factor : 1) 1.0000 2) 1.0000
3) 1.0000 4) 1.0000
4.Rec. range : 0.00A ~ 1.00A
5.Temp. control : None
6.Time scale : sec
7.Baseline correction
Input item No. (START to Meas.)
CallCurv DataList SmplCntl SavParam
Shows the measurement wavelength is set to λ1, λ2
Button to do baseline correction including the wave length of 1.

**Fig. 6.4.1 Parameters setting screen (1 cell kinetics measurement (2 λ))**



### Explanation of setting items

1. λ

   This item is used to set the measurement wavelength of λ 1 and λ 2.

   The input range is from 190.0 to 1100.0. Unit is nm.

2. No. of measurements, cycle, lag/rate

   The number of measurements is used to set the number of measurements with respect to one sample. The input range is from 2 to 330.

   The cycle is the time from when one sampling is completed to the next sampling. When the unit is sec, the lower limit of the input range will be restricted by the wavelength to be set. When the time consumed actually for moving wavelength has exceeded the set cycle, the cycle during measurement will be changed to the actual time. The upper limit will be determined based on the setting of the number of measurements. The upper limit value will be set so that the time value determined by Cycle ×(No. of measurements - 1) will be less than 6553.

   Lag indicates the lag time. After the measurement is started, an interval which is not used for activity value calculation is input by the time from when the measurement is started. Rate indicates the rate time and is used to input the time for activity value calculation immediately after the lag time. The input range of lag and rate is different from that of the one wavelength kinetics. Since at least two samplings (one cycle) are necessary for calculation of the rate of change, the upper limit of lag will be the value subtracted of such sampling. Therefore, the input range of lag is from 0 to {Cycle ×(No. of measurements - 1) - Cycle}. When the lag is 0, the lower limit of rate is one cycle, and except when the lag is not 0, the lower limit of rate will be (Cycle)×2 - (Lag). Since the upper limit is the time where the lag is subtracted from the total measurement time, it will be (Cycle)×(No. of measurements - 1) - (Lag).

3. Factor

The factor is a coefficient used to connect the rate of change of absorbance in terms of the activity value. Four kinds of factors are set respectively. The relation between them is as follows:

(Activity value)= (Factor 1)×(Factor 2)×(Factor 3)×(Factor 4)×(Rate of change)

Input range is from -9999.9 to 9999.9.

4. Recording range

The recording range is used to input the upper limit/lower limit of the Y-axis when displaying the Reaction Curve on the screen.

Input range is from -3.99 to 3.99.

5. Sample temperature control

This is an item provided to install electronic cold energy type temperature control sipper TSU-2200 (optional) to enable temperature setting from the main unit of spectrophotometer.

Setting items are 25℃, 30℃, 37℃ and None (no temperature control), a total of four items.

6. Time unit

The unit of time can be changed by (minute) and (second). When the key is pressed, the unit of time of the item 2 is changed from min to sec and vice versa.

7. Baseline

This item is used for the baseline correction including the wavelength set by the measurement wavelength of 1.

CallCurv

(F1): Pressing this function key enables to call on the screen the curve data stored in the memory of the main unit or the data pack (optional). When the reaction curve is recalled, the activity value is calculated by the factor value set on the parameters setting screen with respect to the recalled waveform data, and the results will be displayed.

DataList

(F2): When this function key is pressed, the Data Table screen will be displayed. Measurement results (sample number, initial value (ABS), △ A/min, activity value) will be tabulated.

SmplCntl

(F3): When this function key is pressed, the sample compartment to be used or parameters of the sample compartment will be set. (See 2.3.7 Sample Control [SmplCntl].)

SavParam

(F4): When this function key is pressed, it is possible to save the current measurement parameters in the memory of the main unit or the data pack (optional).

### 6.4.3 Reaction curve

After the measurement is completed, measurement results will be displayed on the data table and the screen will be changed to one showing the reaction curve. (Fig. 6.4.2) The dotted line in the display screen indicates the calculation interval (the end of lag time and the end of rate time) of the activity value. x indicates the sampling point.

When a printer is connected, measurement results will be printed on the data table every time the measurement is completed. Fig. 6.4.3 shows a printed example.

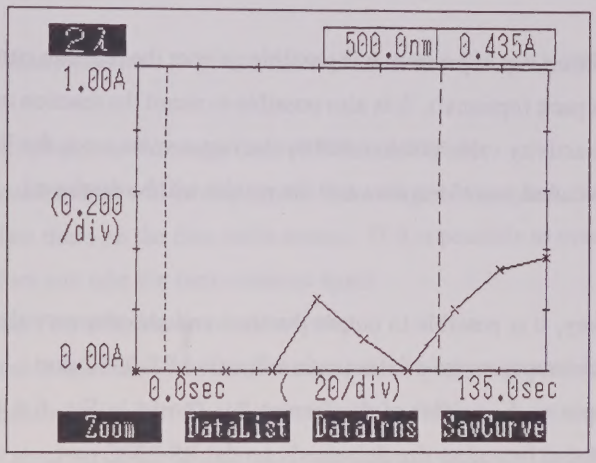


**Fig. 6.4.2 Reaction curve screen (1 cell kinetics (2 λ ))**

| No. | Init.ABS | dA/min | Activ. |
|---|---|---|---|
| 1 | −0.001 | −0.0654 | −0.0654 |
| 2 | −0.237 | 4.0289 | 4.0289 |
| 3 | 0.461 | 0.1893 | 0.1893 |

**Fig. 6.4.3 Example of printed measurement results (1 cell kinetics (2 λ ))**

Zoom

(F1): Changing the range of Y-axis and X-axis of displayed reaction curve enables zooming of the reaction curve. After execution, this function returns to the Restore enables the status to return to one before zooming.

Data are available per sampling only. When a value of the X-axis (time axis) is input at a point other than the sampling point, the nearest sampling point including the input time is replaced with the input value of the X-axis and displayed.

DataList

(F2): Pressing this function key changes the screen to one showing the data table. Measurement results (sample number, initial value (ABS), △ A/min, activity value) will be displayed in tabular format. (See 6.6 Data list.)

DataOutput

(F3): When this function key is pressed, the time and absorbance value per sampling point of reaction curve will be output on the printer (optional) or the RS-232C port. (See 6.4.4. Data Output.)

SavCurv

(F4): When this function key is pressed, it is possible to save the reaction curve in the memory of the main unit or the data pack (optional). It is also possible to recall the reaction curve. When the reaction curve is recalled, the activity value is calculated by the factor value set in the Parameters Setting screen with respect to the recalled waveform data and the results will be displayed.



### 6.4.4 Data output

With this function key, it is possible to output the time and absorbance value per sampling point of reaction curve will be output on the printer (optional) or the RS-232C port.

An example of output to the printer of the format 1 is shown in Fig. 6.4.4. The same display of character-string will also be output simultaneously on the RS-232C port.

The format 2 (RS-232C) will not be outputted to the printer. Time and absorbance will be output in pairs to the RS-232C port excepting the header and data number of the format 1.

| No. | Time(sec) | ABS |
|---|---|---|
| 1 | 0.0 | 0.461 |
| 2 | 2.0 | 0.372 |
| 3 | 4.0 | 0.742 |
| 4 | 6.0 | 0.734 |
| 5 | 8.0 | 0.614 |
| 6 | 10.0 | 0.764 |
| 7 | 12.0 | 0.648 |
| 8 | 14.0 | 0.731 |
| 9 | 16.0 | 0.770 |
| 10 | 18.0 | 0.438 |
| 11 | 20.0 | -0.028 |

**Fig. 6.4.4 Example of printed output format 1 (1 cell kinetics (2 λ ))**

# 6.5 Rate measurement

## 6.5.1 Operation

The rate measurement mode is used to measure the change in time of absorbance for one wavelength just as the 1 cell kinetics measurement (1???). In this mode, no display is shown on the reaction curve screen. The change in quantity of absorbance per set cycle is calculated in terms of the change in quantity per minute. The cycle time here is equivalent to the rate time.

Linear regression of the sampling data during one cycle is carried out by the method of least squares to obtain the rate of change (△ Abs/min). Activity values are obtained by multiplying the rate of change by four factor values.

(Activity value)=(Factor 1)×(Factor 2)×(Factor 3)×(Factor 4)×(Rate of change)

Activity values are displayed in the range from -9999.9 to 9999.9.

If this range is exceeded, ##### will be displayed. If the range is exceeded, change the set values of the factor and re-calculate them on the data table screen. If it is possible to predict the exceeded range, adjust the factor values and take the measurement again.

The initial value is the first absorbance of each cycle.

A discriminant is used to determine whether the reaction is being progressed linearly and to display the linearity (L) or the non-linearity (N). The discriminant is as follows. It determines whether the ratio of the rate of change of absorbance due to the reaction during one cycle and the rate of change of one cycle before is within the proportion (%) set in the criteria.

(Discriminant)

|{(rate of change of one cycle before)-(rate of change of cycle)}/ (rate of change of one cycle before)|× 100<(criteria)

## 6.5.2 Setting measurement parameters

Parameters displayed on the Measurement Parameters screen can be changed by entering the number of the item using keys. Interactive method is the same as that of the main unit of spectrophotometer.

Fig. 6.5.1 shows the Parameters Setting screen for the rate measurement.

For setting the measurement wavelength, the (GOTO WL) key is used.

When setting is completed, press the (START/STOP) key and the screen will change to the measurement screen and the measurements start. When setting the sample number in advance, pressing the [DataList] (F2) function key will display the screen of data table for setting the sample number.

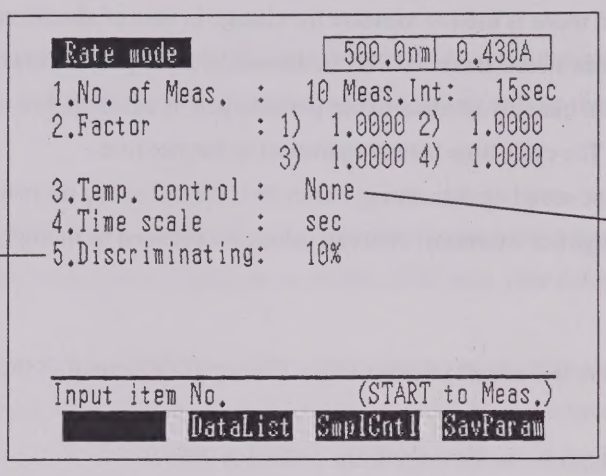
Rate mode
500.0nm 0.430A
1.No. of Meas. : 10 Meas.Int: 15sec
2.Factor : 1) 1.0000 2) 1.0000
3) 1.0000 4) 1.0000
3.Temp. control : None
4.Time scale : sec
5.Discriminating: 10%
Input item No. (START to Meas.)
DataList SmplCntl SavParam
Shows the TSU (option) control temperature.
Indicates the proportion for discriminating linearity.

**Fig. 6.5.1 Parameters setting screen (Rate measurement)**



## Explanation of setting items

1. No. of measurements, cycle

   Number of measurements is used to set the number of rates to be measured with respect to one sample. The input range is from 2 to 117.

   The cycle is the time of one rate measurement of each sample.

   If the unit is sec, the input range is from 3 to 6553, and if the unit is min, the input range is from 1 to 6553.

2. Factor

   The factor is a coefficient used to connect the rate of change of absorbance in terms of the activity value. Four kinds of factors are set respectively. The relation between them is as follows:

   (Activity value)= (Factor 1)×(Factor 2)×(Factor 3)×(Factor 4)×(Rate of change)

   Input range is from -9999.9 to 9999.9.

3. Sample temperature control

   This is an item provided to install electronic cold energy type temperature control sipper TSU-2200 (optional) to enable temperature setting from the main unit of spectrophotometer.

   Setting items are 25℃, 30℃, 37℃ and None (no temperature control), a total of four items.

4. Time unit

   The unit of time can be changed by (minute) and (second). When the key is pressed, the unit of time of the item 1 is changed from min to sec and vice versa.

5. Discriminating

   A discriminant is used to determine whether the reaction is being progressed linearly and to display the

linearity (L) or the non-linearity (N). The discriminant is as follows. It determines whether the ratio of the rate of change of absorbance due to the reaction during one cycle and the rate of change of one cycle before is within the proportion (%) set in the criteria.

(Discriminant)

|{(rate of change of one cycle before)-(rate of change of cycle)}/ (rate of change of one cycle before)|× 100<(criteria)

DataList

(F2): Pressing this function key changes the screen to one showing the data table. Measurement results (Time, initial value (ABS), △ A/min, activity value, judgment results (D)) will be displayed in tabular format.

SmplCntl

(F3): When this function key is pressed, the sample compartment to be used or parameters of the sample compartment will be set. (See 2.3.7 Sample Control [SmplCntl].)

SavParam

(F4): When this function key is pressed, it is possible to save the current measurement parameters in the memory of the main unit or the data pack (optional).



### 6.5.3 Measurement screen (Data List)

During measurements, the screen will display measurement results per successive cycle on the data list.

Fig. 6.5.2 shows the screen of the data list after the measurement is completed.

When a printer (optional) is connected, measurement results displayed on the data list per measurement cycle will be printed.

Fig. 6.5.3 shows an example of printed measurement results.

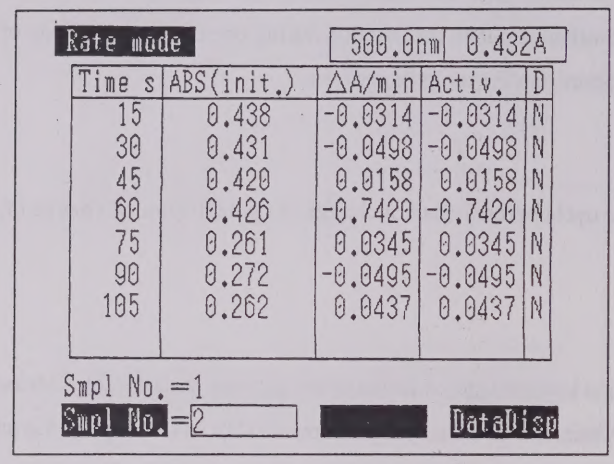


**Fig. 6.5.2 Reaction curve screen (Rate measurement)**



Sample No. = 1

| Time(sec) | Init.ABS | dA/min | Activ. | D |
|---|---|---|---|---|
| 5 | 1.142 | -0.3413 | -3.4131 | N |
| 10 | 1.113 | -0.2900 | -2.9004 | N |
| 15 | 1.089 | -0.2476 | -2.4756 | N |
| 20 | 1.068 | -0.2402 | -2.4023 | L |
| 25 | 1.048 | -0.2241 | -2.2412 | L |
| 30 | 1.030 | -0.2168 | -2.1680 | L |
| 35 | 1.012 | -0.1743 | -1.7432 | N |
| 40 | 0.997 | -0.1553 | -1.5527 | N |
| 45 | 0.984 | -0.1509 | -1.5088 | L |
| 50 | 0.972 | -0.1597 | -1.5967 | L |
| 55 | 0.958 | -0.1377 | -1.3770 | N |
| 60 | 0.947 | -0.1260 | -1.2598 | L |
| 65 | 0.936 | -0.1187 | -1.1865 | L |
| 70 | 0.926 | -0.1099 | -1.0986 | L |
| 75 | 0.917 | -0.1025 | -1.0254 | L |
| 80 | 0.909 | -0.0981 | -0.9814 | L |
| 85 | 0.901 | -0.0879 | -0.8789 | N |
| 90 | 0.893 | -0.1025 | -1.0254 | N |
| 95 | 0.885 | -0.0850 | -0.8496 | N |
| 100 | 0.878 | -0.0894 | -0.8936 | L |

**Fig. 6.5.3 Example of printed measurement results (Rate measuerment)**

Smpl No.

(F1): With this function key, it is possible to change the number of the sample to be measured next. The input range of the sample number is from 0 to 9999.

DataDisp

(F4): Pressing this function key changes the screen to that of tabulated data. All of the measurement results can be displayed or printed. It is also possible to save and delete the tabulated data. (See 6.5.4. List display of rate measurement.)

### 6.5.4 List display of rate measurement

Fig. 6.5.4 shows the screen of list display, on which results of rate measurement can be listed for review. It is also possible to output a batch of all measurement results on a printer or store them in the memory of the main unit or the data pack (optional).

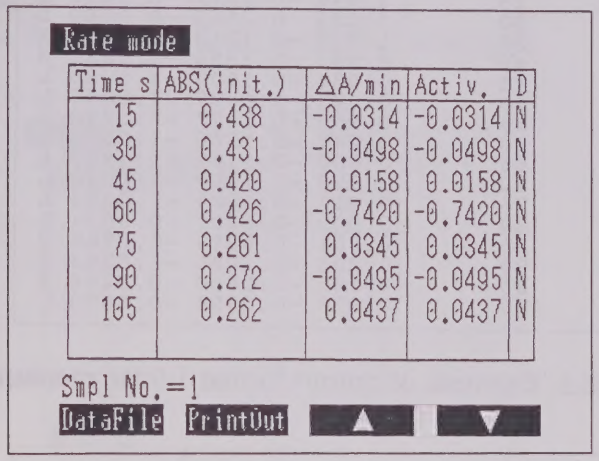


**Fig. 6.5.4 Screen of list display (rate measurement)**

DataFile

(F1): This function key enables storing measurement results into the memory of the main unit or the data pack (optional).

PrintOut

(F2): Pressing this function key outputs a batch of all measurement results (time), initial value (ABS), △A/min, activity value and judgment results (D) on a printer (optional) or on the RS-232C port. Three kinds of formats are available.

△, ▽

(F3),(F4) : This function key enables scrolling of measurement results by 8 data.

Output format of PrintOut will be as follows.:

An example of the format 1 output on the printer is shown in Fig. 6.5.5. The same character-string of the same data will be output simultaneously on the RS-232C port.

Fig. 6.5.6 shows an example of the format 2 output on the printer. The same character-string of the same data will be output on the RS-232C port.

The format 3 will not be output on the printer. Except the header to the format 1, time, initial value

(ABS), △ A/min, activity value and judgment results (D) are output on the RS-232C port in that order.

```
Sample No. = 1
 Time(sec) Init.ABS  dA/min  Activ. D
-------------------------------------
      5      1.142 -0.3413 -3.4131 N
     10      1.113 -0.2900 -2.9004 N
     15      1.089 -0.2476 -2.4756 N
     20      1.068 -0.2402 -2.4023 L
     25      1.048 -0.2241 -2.2412 L
     30      1.030 -0.2168 -2.1680 L
     35      1.012 -0.1743 -1.7432 N
     40      0.997 -0.1553 -1.5527 N
     45      0.984 -0.1509 -1.5088 L
     50      0.972 -0.1597 -1.5967 L
     55      0.958 -0.1377 -1.3770 N
     60      0.947 -0.1260 -1.2598 L
     65      0.936 -0.1187 -1.1865 L
     70      0.926 -0.1099 -1.0986 L
     75      0.917 -0.1025 -1.0254 L
     80      0.909 -0.0981 -0.9814 L
     85      0.901 -0.0879 -0.8789 N
     90      0.893 -0.1025 -1.0254 N
     95      0.885 -0.0850 -0.8496 N
    100      0.878 -0.0894 -0.8936 L
```

**Fig. 6.5.5 Example of output format 1 (rate measurement)**

```
Sample No. = 1
Init.ABS  dA/min  Activ.
-----------------------
 Time(sec)     5    D:N
   1.142 -0.3413 -3.4131
 Time(sec)    10    D:N
   1.113 -0.2900 -2.9004
 Time(sec)    15    D:N
   1.089 -0.2476 -2.4756
 Time(sec)    20    D:L
   1.068 -0.2402 -2.4023
 Time(sec)    25    D:L
   1.048 -0.2241 -2.2412
 Time(sec)    30    D:L
   1.030 -0.2168 -2.1680
```

**Fig. 6.5.6 Example of output format 2 (rate measurement)**

As shown in Fig. 6.6.1, measurement results (Smpl No., ABS (init.), △ A/min, Activ) will be displayed in the tabular format. Measurement results will be added below every time a measurement or re-calculation is made. The maximum number of data of measurement results is 105. To save or delete these measurement results, press the [DataDisp](F4) function key to bring up the screen of data display for further processing.

Lag time and rate time displayed on the lower row see the newest results.

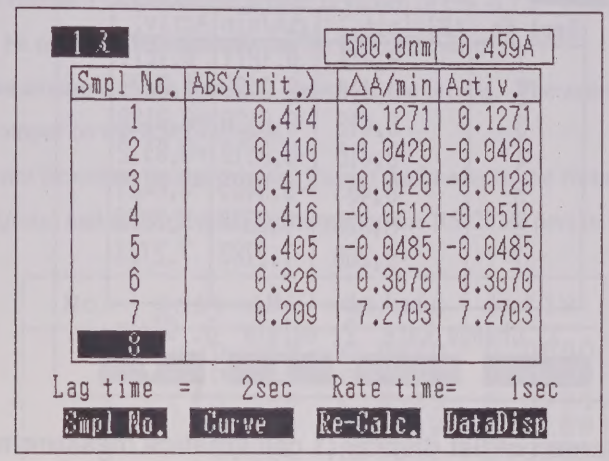


**Fig. 6.6.1 Screen of data list (1 cell kinetics measurement (1 λ))**

Smpl No.

(F1): With this function key, it is possible to change the number of the sample to be measured next. The input range of the sample number is from 0 to 9999.

Curve

(F2): Pressing this function key changes the screen to that of the reaction curve.

Re-Calc.

(F3): With this function, it is possible to change the lag time and rate time to re-calculate the activity value. Results of re-calculation will be displayed with the original sample number provided with numbers with dash. One sample can be re-calculated for up to 9 times.

DataDisp

(F4): Pressing this function key changes the screen to that of tabulated data. All of the measurement results can be displayed or printed. It is also possible to save and delete the tabulated data. (See 6.7 List display.)

Fig. 6.7.1 shows the screen of list display. In the screen of the data list, results of only 7 measurements taken immediately before will be displayed. In this case, it is possible to display all of the measurement results. It is also possible to output a batch of all measurement results on a printer or store them in the memory of the main unit or the data pack (optional). Part of measurement results or all of the measurement results may be deleted or erased. Rate of change may be input in manual mode.

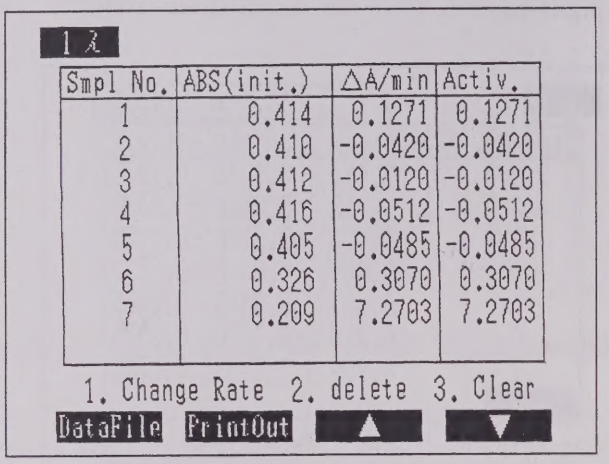


**Fig. 6.7.1 Screen of list display (1 cell kinetics measurement (1 λ ))**

1. Change Rate

In this mode, it is possible to input the value of the rate of change (△ A/min) and change it using keys. When the rate of change is changed, the activity value will be re-calculated by the factor used for measurements.

The input range is from -9999.9 to 9999.9.

2. Delete

With this mode, it is possible to delete any of the measurement results. Select data to be deleted with the cursor key and press the (ENTER) key. Defective data can be deleted.

3. Clear

A batch of all measurement results will be erased.

DataFile

(F1): This function key enables storing measurement results into the memory of the main unit or the data pack (optional).

PrintOut

(F2): Pressing this function key outputs a batch of all measurement results (sample No., initial value (ABS), △ A/min, and activity value) on a printer (optional) or on the RS-232C port. Three kinds of

formats are available.

△, ▽

(F3),(F4) : This function key enables scrolling of measurement results by 8 data.

Output format of PrintOut will be as follows.:

An example of the format 1 output on the printer is shown in Fig. 6.7.2. The same character-string of the same data will be output simultaneously on the RS-232C port.

Fig. 6.7.3 shows an example of the format 2 output on the printer. The same character-string of the same data will be output on the RS-232C port.

The format 3 will not be output on the printer. Except the header to the format 1, sample No., initial value (ABS), △ A/min, and activity value are output on the RS-232C port in that order.

| No. | Init.ABS | dA/min | Activ. |
|---|---|---|---|
| 1 | 0.138 | 0.0690 | 0.0690 |
| 2 | 0.143 | 0.0490 | 0.0490 |
| 3 | 0.189 | 0.0325 | 0.0325 |
| 4 | 0.096 | 0.0289 | 0.0289 |
| 5 | 0.114 | 0.0201 | 0.0201 |
| 6 | 0.082 | 0.0148 | 0.0148 |
| 7 | 0.119 | 0.0122 | 0.0122 |
| 8 | 0.120 | 0.0097 | 0.0097 |
| 9 | 0.632 | 0.0629 | 0.0629 |
| 10 | 0.469 | 0.0462 | 0.0462 |
| 11 | 0.379 | 0.0380 | 0.0380 |
| 12 | 0.307 | 0.0260 | 0.0260 |
| 13 | 0.244 | 0.0163 | 0.0163 |
| 14 | 0.187 | 0.0131 | 0.0131 |
| 15 | 0.185 | 0.0100 | 0.0100 |
| 16 | 0.190 | 0.0072 | 0.0072 |
| 17 | 1.060 | 0.0613 | 0.0613 |
| 18 | 0.783 | 0.0401 | 0.0401 |
| 19 | 0.634 | 0.0350 | 0.0350 |
| 20 | 0.483 | 0.0223 | 0.0223 |
| 21 | 0.356 | 0.0153 | 0.0153 |
| 22 | 0.275 | 0.0117 | 0.0117 |
| 23 | 0.233 | 0.0087 | 0.0087 |
| 24 | 0.239 | 0.0073 | 0.0073 |
| 33 | 1.614 | 0.0588 | 0.0588 |
| 34 | 1.144 | 0.0371 | 0.0371 |
| 35 | 0.949 | 0.0334 | 0.0334 |
| 36 | 0.690 | 0.0224 | 0.0224 |
| 37 | 0.473 | 0.0123 | 0.0123 |
| 38 | 0.383 | 0.0105 | 0.0105 |
| 39 | 0.313 | 0.0078 | 0.0078 |
| 40 | 0.304 | 0.0069 | 0.0069 |

**Fig. 6.7.2 Example of output format 1 (1 cell kinetics (1 λ))**

| Init.ABS | dA/min | Activ. |
|---|---|---|
| No. 1 | | |
| 0.138 | 0.0690 | 0.0690 |
| No. 2 | | |
| 0.143 | 0.0490 | 0.0490 |
| No 3 | | |
| 0.189 | 0.0325 | 0.0325 |
| No. 4 | | |
| 0.096 | 0.0289 | 0.0289 |
| No. 5 | | |
| 0.114 | 0.0201 | 0.0201 |
| No. 6 | | |
| 0.082 | 0.0148 | 0.0148 |
| No. 7 | | |
| 0.119 | 0.0122 | 0.0122 |
| No. 8 | | |
| 0.120 | 0.0097 | 0.0097 |
| No. 9 | | |
| 0.632 | 0.0629 | 0.0629 |
| No. 10 | | |
| 0.469 | 0.0462 | 0.0462 |
| No. 11 | | |
| 0.379 | 0.0380 | 0.0380 |
| No. 12 | | |
| 0.307 | 0.0260 | 0.0260 |
| No. 13 | | |
| 0.244 | 0.0163 | 0.0163 |
| No. 14 | | |
| 0.187 | 0.0131 | 0.0131 |
| No. 15 | | |
| 0.185 | 0.0100 | 0.0100 |
| No. 16 | | |
| 0.190 | 0.0072 | 0.0072 |
| No. 17 | | |
| 1.060 | 0.0613 | 0.0613 |
| No. 18 | | |
| 0.783 | 0.0401 | 0.0401 |
| No. 19 | | |
| 0.634 | 0.0350 | 0.0350 |
| No. 20 | | |
| 0.483 | 0.0223 | 0.0223 |
| No. 21 | | |
| 0.356 | 0.0153 | 0.0153 |
| No. 22 | | |
| 0.275 | 0.0117 | 0.0117 |
| No. 23 | | |
| 0.233 | 0.0087 | 0.0087 |
| No. 24 | | |
| 0.239 | 0.0073 | 0.0073 |
| No. 33 | | |
| 1.614 | 0.0588 | 0.0588 |
| No. 34 | | |
| 1.144 | 0.0371 | 0.0371 |
| No. 35 | | |
| 0.949 | 0.0334 | 0.0334 |
| No. 36 | | |
| 0.690 | 0.0224 | 0.0224 |
| No. 37 | | |
| 0.473 | 0.0123 | 0.0123 |
| No. 38 | | |
| 0.383 | 0.0105 | 0.0105 |
| No. 39 | | |
| 0.313 | 0.0078 | 0.0078 |
| No. 40 | | |
| 0.304 | 0.0069 | 0.0069 |

**Fig. 6.7.3 Example of output format 2 (1 cell kinetics (1 λ ))**

# 6.8 Reaction curve (waveform data) and measurement results (list data)

With this measurement mode, it is possible to store the two kinds of data of the reaction curve (waveform data) and measurement results (list data) into the memory of the main unit or the data pack (optional) or recall them.

The reaction curve can be processed with the SavCurve and CallCurv and the measurement results can be processed with the DataFile, but No.0.Original will always be the waveform data during measurement when the list of file is displayed.

It is possible to store 6 files into the memory of the main unit and 27 files into the data pack, including the original. However, the waveform data and list data will be mixed and present when the list of file is displayed. Even with Header function, "special format" will displayed for all measurements except the reaction curve of 1 cell kinetics measurement (1 $\lambda$ ). Therefore, when the measurement data of various measurement modes are mixed and present, it is necessary to devise how to designate the file name because it will be difficult to discriminate files.

# Chapter 7
# Time scan Mode



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# 7 Time scan mode

The time scan mode is used to measure the change in time of absorbance (ABS), transmittance (%T), or energy (E) in the specified arbitrary wavelength.

Following two measurement methods are provided:

- 1 cell measurement
- Multi-cell measurement (optional sample compartment is required.)

With multi-cell measurement, maximum 16 samples can be measured by connecting the multi-cell, micro multi-cell, or CPS-240 (all supplied as an optional.)

# 7.1 Selecting the measurement method

When <5. Time scan> is selected on the mode selection screen, the following measurement method selection screen (Fig. 7.1) is displayed.

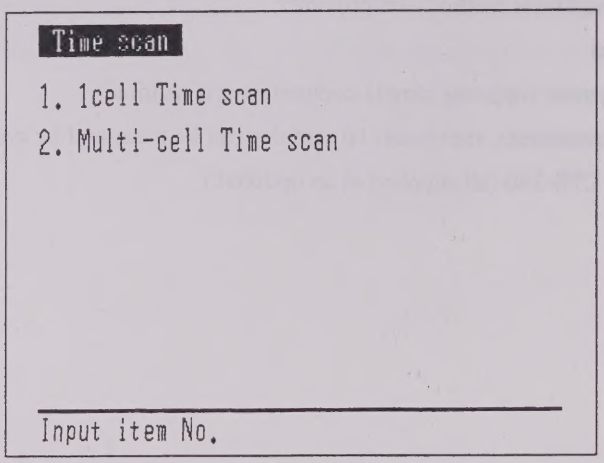


**Fig. 7.1 Measurement method selection screen**



The time scan mode is provided with two types of measurement method. Overview of each measurement method is as follows.

(1) 1 cell measurement

This method is used to measure the change in time of absorbance or transmittance of arbitrary one cell in the sample chamber.

(2) Multi-cell measurement

This method is used to measure the change in time of max. 16 samples, using accessories such as multi-cell, micro multi-cell, and CPS-240.

### 7.2.1 Setting the parameters

When <1. 1 cell Time scan> is selected from the measurement method selection screen to display the measurement parameters setting screen (Fig. 7.2).

Set the respective items of measurement parameters by key dialog method. Condition to be set is selected by inputting the item number.

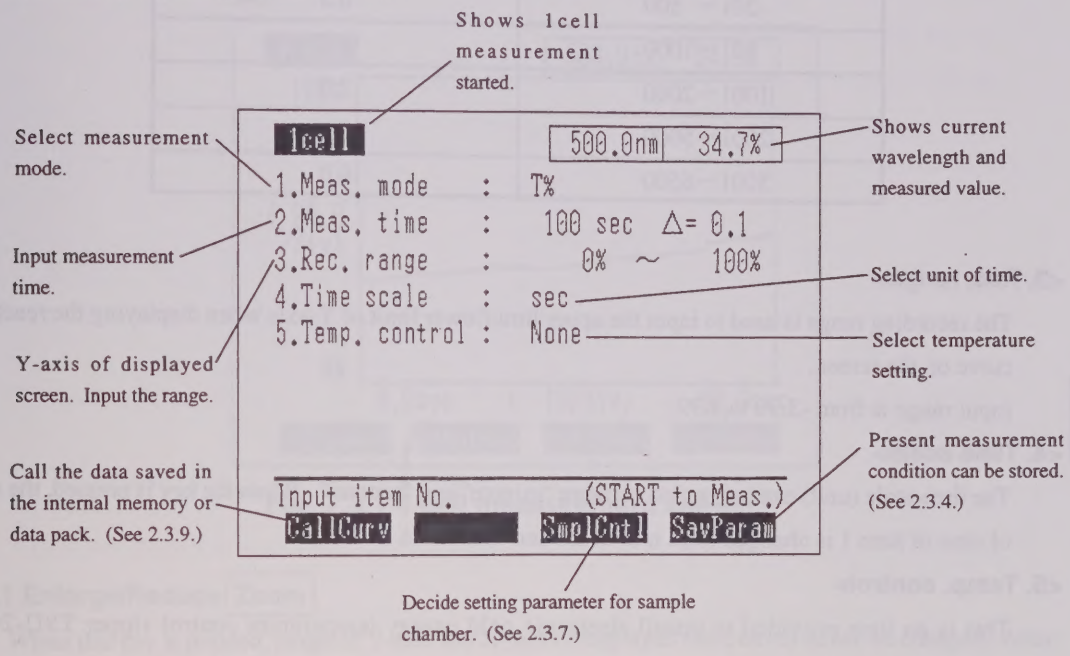
Shows 1cell measurement started.
Select measurement mode.
Input measurement time.
Y-axis of displayed screen. Input the range.
Call the data saved in the internal memory or data pack. (See 2.3.9.)
1cell
500.0nm 34.7%
1.Meas. mode : T%
2.Meas. time : 100 sec Δ= 0.1
3.Rec. range : 0% ~ 100%
4.Time scale : sec
5.Temp. control : None
Input item No. (START to Meas.)
CallCurv
SmplCntl
SavParam
Shows current wavelength and measured value.
Select unit of time.
Select temperature setting.
Present measurement condition can be stored. (See 2.3.4.)
Decide setting parameter for sample chamber. (See 2.3.7.)

**Fig. 7.2 1 cell measurement parameters setting screen**

**<1. Meas. mode>**

Select absorbance (ABS), transmittance (%T), or energy (E).

**<2. Meas. Time>**

Input the measurement time. Sampling interval is automatically set in accordance with the measurement time (see Table 7.1).

**Table 7.1 Measurement time and sampling interval**

| Measurement time | Sampling interval |
|---|---|
| 1～ 100 | 0.1 |
| 101～ 200 | 0.2 |
| 201～ 500 | 0.5 |
| 501～1000 | 1.0 |
| 1001～2000 | 2.0 |
| 2001～5000 | 5.0 |
| 5001～6500 | 10.0 |

**<3. Rec. range>**

The recording range is used to input the upper limit/lower limit of Y-axis when displaying the reaction curve on the screen.

Input range is from -3.99 to 3.99.

**<4. Time scale>**

The time scale (unit) can be toggled between "minute" and "second". When the key is pressed, the unit of time of item 1 is changed from min to sec and vice versa.

**<5. Temp. control>**

This is an item provided to install electronic cold energy temperature control sipper TSU-2000 (optional) to enable temperature setting from the spectrophotometer main unit.

Setting item is a total of four items: 25℃, 30℃, 37℃, and none (no temperature control)

### 7.2.2 Call Curve [CallCurv]

Pressing this function key enables to call on the screen the curve data recorded in the memory of the main unit or the data pack (optional). (See 2.3.9 Save Curve [SavCurve] and Call Curve [CallCurv].)

7.2.3 Sample Control [SmplCntl]

This function key is used to set the parameters of sample chamber to be used or number of cells.

(See 2.3.7 Sample Control [SmplCntl].)

### 7.2.3 Save Parameters [SavParam]

When this function key is pressed, the current measurement parameters can be saved in the memory of the main unit or the data pack (optional).

(See 2.3.4 Save Parameters [SavParam].)

# 7.3 Reaction curve (1 cell measurement)

When [START] key is pressed on the parameter setting screen, the screen to display the reaction curve appears, on which the change in time of absorbance (transmittance or energy) of the sample is displayed in real-time. (Fig. 7.3.1)

When the measurement is completed, press the cursor key (◁ or ▷) to display the cursor, and the time and the measured value at the cursor position can be read.

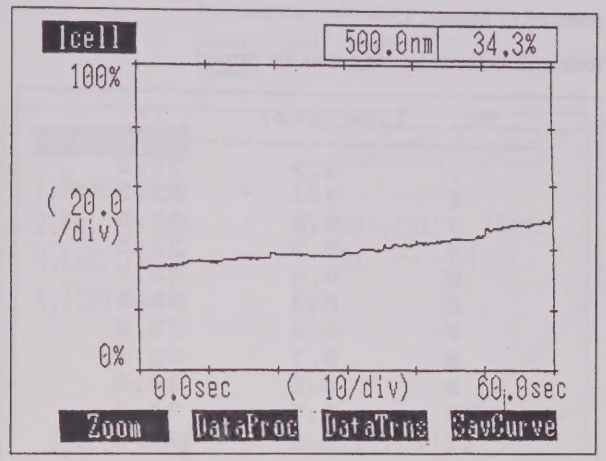


**Fig. 7.3.1 1 cell measurement screen**

### 7.3.1 Enlarge/Reduce [Zoom]

When this key is pressed, range of Y-axis and X-axis of displayed reaction curve can be changed. After execution, this function returns to the [Restore] and enables the status return to one before zooming. Data are available only in sampling interval. When a value of the X-axis (time axis) is input at a point other than the sampling point, the nearest sampling point including the input time is replaced with the input value of the X-axis and then displayed.

### 7.3.2 Data Processing [DataProc]

It is possible to perform data processing such as differential, four basic operations of arithmetic, and area calculation is possible for the measured data.

(See 2.3.15 Data Processing [DataProc].)

### 7.3.3 Data Transmission [DataTrns]

When this function key is pressed, the time and absorbance value (transmittance value or energy value) per sampling point of reaction curve will be output to the printer of RS-232C port.

Following two output formats are provided. Select with the cursor key (◁ or ▷) and press [ENTER].

Format 1

An example of output to the printer is shown in Fig. 7.3.2. The character-string of same contents will also be simultaneously output to the RS-232C.

Format 2 (RS-232C)

Time and absorbance (transmittance or energy) will be output to the RS-232C port excluding the header and data number of format 1.

In this case, the format 2 will not be output to the printer.

| No. | Time(sec) | T% |
|---|---|---|
| 1 | 0.0 | 33.5 |
| 2 | 0.1 | 33.5 |
| 3 | 0.2 | 33.5 |
| 4 | 0.3 | 33.5 |
| 5 | 0.4 | 33.7 |
| 6 | 0.5 | 33.6 |
| 7 | 0.6 | 33.8 |
| 8 | 0.7 | 33.8 |
| 9 | 0.8 | 34.0 |
| 10 | 0.9 | 34.0 |
| 11 | 1.0 | 34.0 |

**Fig. 7.3.2 Example of printed data output format 1 (1 cell measurement)**

### 7.3.4 Save Curve SavCurv

When this function key is pressed, it is possible to save the reaction curve in the memory of the main unit or the data pack (optional).

(See 2.3.9 Save Curve SavCurve.)

### 7.4.1 Setting the parameter item

When <2. Multi-cell Time scan> is selected from the measurement method selection screen, the measurement parameter setting screen is displayed. (Fig. 7.4)

Set the items of measurement parameters by key dialog method. Select parameters to be set by inputting the item number.

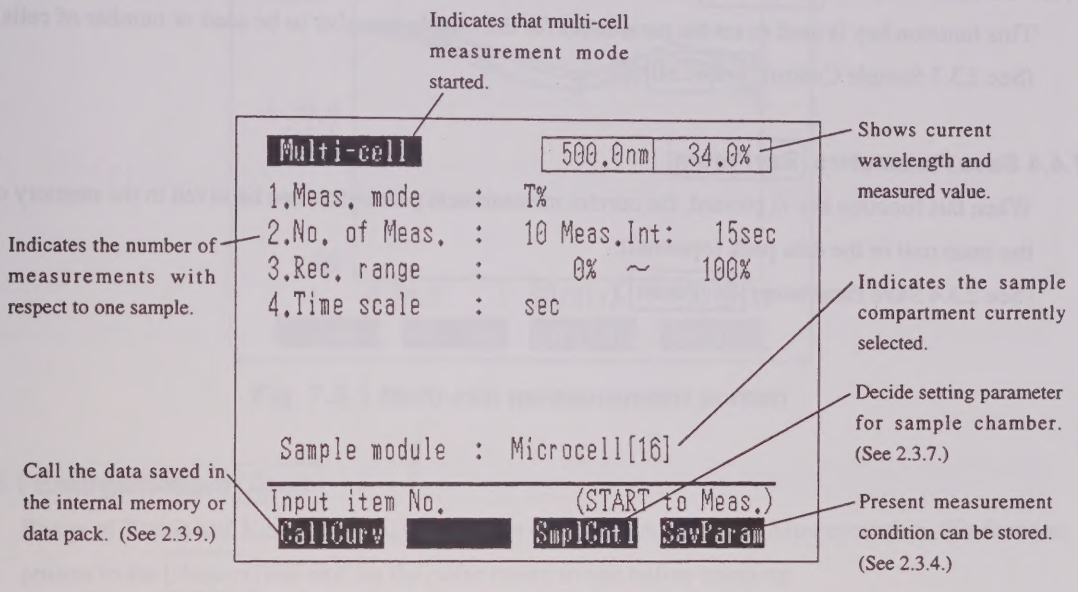
Indicates that multi-cell measurement mode started.
Multi-cell
500.0nm 34.0%
Shows current wavelength and measured value.
1.Meas. mode : T%
2.No. of Meas. : 10 Meas.Int: 15sec
3.Rec. range : 0% ~ 100%
4.Time scale : sec
Indicates the number of measurements with respect to one sample.
Indicates the sample compartment currently selected.
Sample module : Microcell[16]
Decide setting parameter for sample chamber. (See 2.3.7.)
Call the data saved in the internal memory or data pack. (See 2.3.9.)
Input item No. (START to Meas.)
CallCurv
SmplCntl
SavParam
Present measurement condition can be stored. (See 2.3.4.)

**Fig. 7.4 Multi-cell measurement parameter setting screen**

**<1. Meas. mode>**

Select absorbance (ABS), transmittance (%), or energy (E).

**<2. No. of Meas.>**

This parameter is used to set the number of measurements to be made with respect to one sample. The input range is 2 to 60. The cycle is the time from when one sampling of each sample is completed to next sampling. The input range is determined depending on the sample chamber and number of cells to be used when the time scale is "sec". (See Table 6.3.1 "Minimum cycle (sec)")

**<3. Rec. range>**

The recording range is used to input the upper limit/lower limit of Y-axis when displaying the Reaction Curve on the screen.

**<4. Time scale>**

The time scale (unit) can be toggled by "minute" and "second". When the key is pressed, the unit of time of item 2 is changed from min to sec and vice versa.

### 7.4.2 Call Curve [CallCurv]

Pressing this function key enables to call on the screen the curve data saved in the memory of the main unit or the data pack (optional). (See 2.3.9 Save Curve [SavCurve] and Call Curve [CallCurv].)

### 7.4.3 Sample Control [SmplCntl]

This function key is used to set the parameters for the sample chamber to be used or number of cells. (See 2.3.7 Sample Control [SmplCntl].)

### 7.4.4 Save Parameters [SavParam]

When this function key is pressed, the current measurement parameters can be saved in the memory of the main unit or the data pack (optional).
(See 2.3.4 Save Parameters [SavParam].)

# 7.5 Reaction curve (Multi-cell measurement)

When START key is pressed on the parameter setting screen, the screen to display the reaction curve appears, on which the change in time of absorbance (transmittance or energy) of the sample is displayed in real-time. (Fig. 7.5.1)

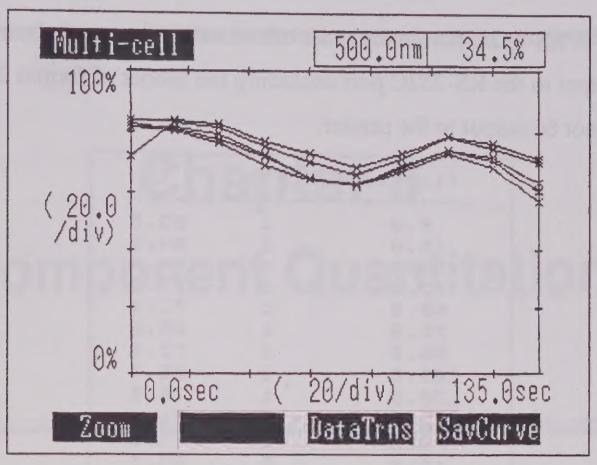


**Fig. 7.5.1 Multi-cell measurement screen**



### 7.5.1 Enlarge/Reduce Zoom

Range of Y-axis and X-axis of displayed reaction curve can be changed. After execution, this function returns to the Restore and enables the status return to one before zooming.

Data are available only in sampling interval. When a value of the X-axis (time axis) is input at a point other than the sampling point, the nearest sampling point including the input time is replaced with the input value of the X-axis and then displayed.

### 7.5.2 Data Transmission DataTrns

When this function key is pressed, the time and absorbance value (transmittance or energy value) per sampling point of reaction curve will be output to the printer or RS-232C port.

Following two output formats are provided. Select with the cursor key (◁ or ▷) and press ENTER.

Format 1

An example of output to the printer is shown in Fig. 7.5.2. The character-string of same contents will also be simultaneously output to the RS-232C.

Format 2

An example of output to the printer is shown in Fig. 7.5.3. The character-string of same contents will also be simultaneously output to the RS-232C.

Format 3 (RS-232C)

Format 3 is output to RS-232C port in the order of time, cell value, and absorbance (transmittance or

energy) will be output to the RS-232C port excluding the header of format 1.

The format 3 will not be output to the printer.

Format 4 (RS-232C)

Format 4 is output to RS-232C port in the order of cell value, time, and absorbance (transmittance or energy) will be output to the RS-232C port excluding the header of format 2.

The format 4 will not be output to the printer.

| Time(sec) | Cell | T% |
|---|---|---|
| 0.0 | 1 | 83.5 |
| 15.0 | 1 | 84.0 |
| 30.0 | 1 | 82.8 |
| 45.0 | 1 | 77.0 |
| 60.0 | 1 | 73.1 |
| 75.0 | 1 | 68.6 |
| 90.0 | 1 | 73.0 |
| 105.0 | 1 | 78.7 |
| 120.0 | 1 | 76.5 |
| 135.0 | 1 | 71.4 |
| 0.0 | 2 | 71.9 |
| 15.0 | 2 | 83.5 |
| 30.0 | 2 | 81.7 |
| 45.0 | 2 | 75.1 |
| 60.0 | 2 | 70.4 |
| 75.0 | 2 | 66.1 |
| 90.0 | 2 | 71.4 |

**Fig. 7.5.2 Example of format 1 printout (Multi-cell measurement)**

| Cell | Time(sec) | T% |
|---|---|---|
| 1 | 0.0 | 83.5 |
| 2 | 0.0 | 71.9 |
| 3 | 0.0 | 81.7 |
| 4 | 0.0 | 82.7 |
| 5 | 0.0 | 81.6 |
| 1 | 15.0 | 84.0 |
| 2 | 15.0 | 83.5 |
| 3 | 15.0 | 81.4 |
| 4 | 15.0 | 81.1 |
| 5 | 15.0 | 80.3 |
| 1 | 30.0 | 82.8 |
| 2 | 30.0 | 81.7 |
| 3 | 30.0 | 79.2 |
| 4 | 30.0 | 77.5 |
| 5 | 30.0 | 76.1 |

**Fig. 7.5.3 Example of format 2 printout (Multi-cell measurement)**

### 7.5.3 Save Curve [SavCurve]

When this function key is pressed, the current measurement parameters can be saved in the memory of the main unit or the data pack (optional).

(See 2.3.4 Save Parameters [SavParam].)

# Chapter 8
# Multi-component Quantitation Mode

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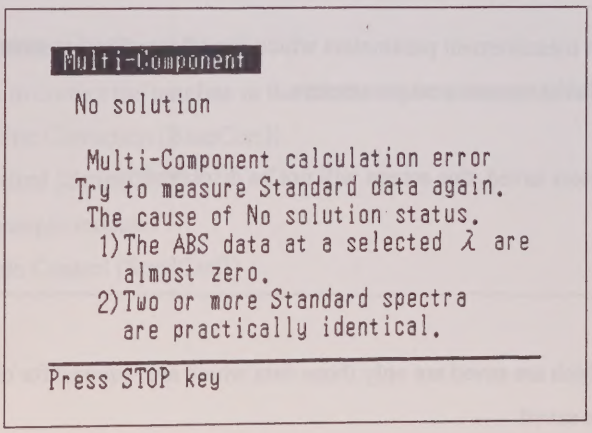
# 8 Multi-component Quantitation Mode

The multi-component quantitation mode is the mode in which the concentration of each constituent component is determined by using the absorption spectrum of the mixed sample with pure standards or standards made up of multiple constituent components.

1) Mixed samples with up to 8 constituent components can be quantitated.
2) In addition to using pure samples of each constituent component as the standard samples, a mixed sample in which the concentration of each constituent component is known may also be used.
   The effects of interference among the various constituent components can be minimized by using a mixed sample as the standard sample.
3) The standard sample data can be saved with the measurement parameters in memory. In addition, a spectrum saved in memory can be used as the standard sample or unknown sample data. However,unlike other parameter files, these can only be saved one at a time.
4) The measurement wavelengths can be set at uniform intervals or randomly set. You can freely select the measurement wavelengths to improve measurement accuracy.

**NOTES!**

1) If Multi-component quantitation calculation cannot be performed due to, e.g., an unsuitable standard sample, the error message "Multi-component calculation error" will be displayed on the screen.


Multi-Component
No solution
Multi-Component calculation error
Try to measure Standard data again.
The cause of No solution status.
1)The ABS data at a selected λ are almost zero.
2)Two or more Standard spectra are practically identical.
Press STOP key

2) If a sample whose absorbance is virtually zero, or a sample with a closely similar absorption spectrum shape is used as the standard sample, isolation quantitation calculations may not be able to be performed or accurate values may not be found.
3) If a mixed sample with 4 or more constituent components is used as the standard sample, it is highly probable that isolation quantitation calculations will not be able to be performed.

# 8.1 Load Stored Measurement Parameters

When you select <5. Multi-Component> in the mode selection screen, a screen will be displayed for loading measurement parameters and standard sample data which have been saved.

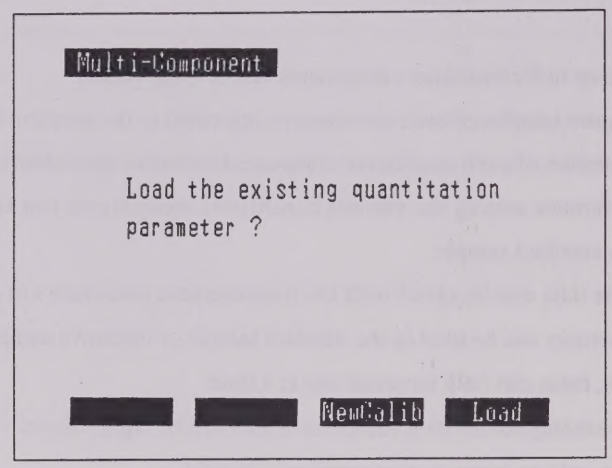



**Fig. 8.1 Load saved parameters screen**

Only one set of the measurement parameters from the multi-component quantitation mode can be saved together with the standard sample data in a separate memory location from other measurement modes.

When you select [Load], the measurement parameters which have been saved in memory are loaded. You may also select [NewCalib] to reset new parameters.

Now, if there are no parameters saved, this screen will not be displayed.

**NOTE!**

Standard sample data which are saved are only those data which are required for quantitation calculations. Spectra cannot be saved.

To save a standard sample spectrum, it must have already been measured in the spectrum mode and the results saved to memory. (See 4.4.5 Save Curve [SavCurve])

Spectrum which have been saved using the [CallCurv] function can be used as standard sample data. (See 7.4.2 Measure Standard Sample)

When you load parameters or select new settings, the parameter configuration screen will be displayed.

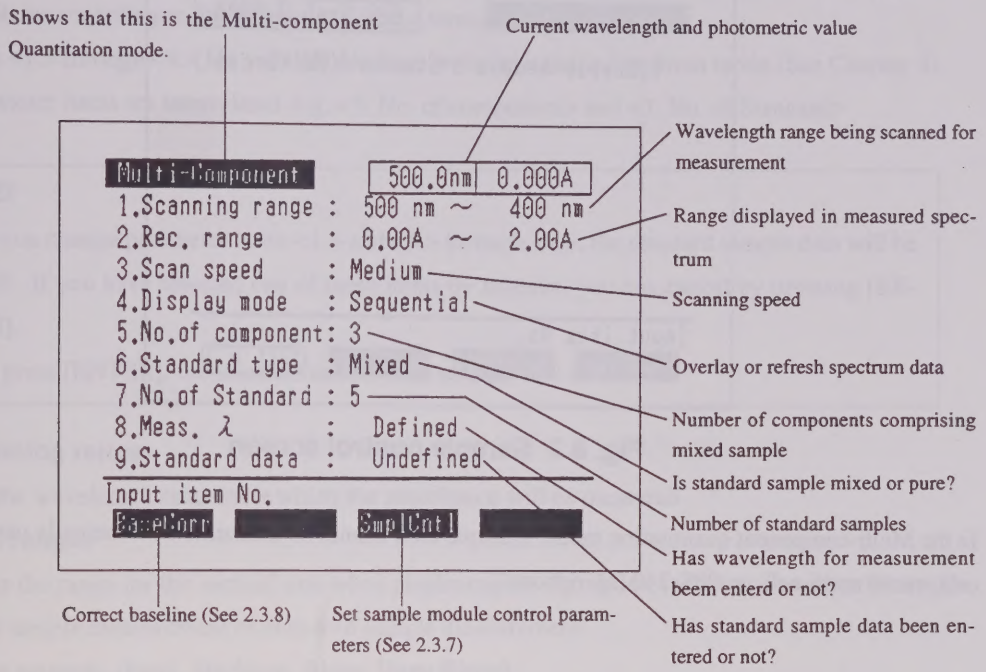

Shows that this is the Multi-component Quantitation mode.
Current wavelength and photometric value
Multi-Component
500.0nm 0.000A
1.Scanning range : 500 nm ~ 400 nm
2.Rec. range : 0.00A ~ 2.00A
3.Scan speed : Medium
4.Display mode : Sequential
5.No.of component: 3
6.Standard type : Mixed
7.No.of Standard : 5
8.Meas. λ : Defined
9.Standard data : Undefined
Input item No.
BaseCorr
SmplCntl
Wavelength range being scanned for measurement
Range displayed in measured spectrum
Scanning speed
Overlay or refresh spectrum data
Number of components comprising mixed sample
Is standard sample mixed or pure?
Number of standard samples
Has wavelength for measurement beem enterd or not?
Has standard sample data been entered or not?
Correct baseline (See 2.3.8)
Set sample module control parameters (See 2.3.7)

**Fig. 8.2 Parameter Configuration screen**

### 8.2.1 Baseline Correction [BaseCorr]

This allows you to correct the baseline in the measurement parameters which have been set.

(See 2.3.8 Baseline Correction [BaseCorr])

### 8.2.2 Sample Control [SmplCntl]

Set the type of sample module.

(See 2.3.7 Sample Control [SmplCntl])

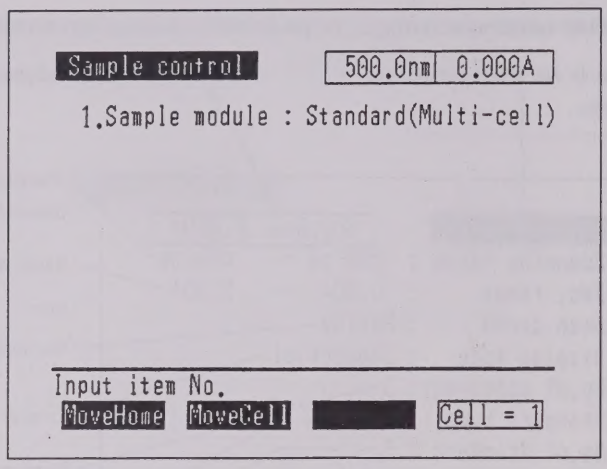



**Fig. 8.3 Sample control screen**

In the Multi-component quantitation mode, multiple cells cannot be measured automatically using a multi-cell, micro multi-cell, or CPS-240 (all options).

# 8.3 Setting Measurement Parameters

The multi-component quantitation mode has more parameters to be set than other measurement modes. Set the various items according to the instructions on the screen.

Parameters <1.> through <4.> are virtually identical with those in the Spectrum mode (See Chapter 4).

Some parameter items are interrelated. e.g. <5. No. of component> and <7. No. of Standard>

**NOTE!**

When you change parameter items <1.> and <5.> through <9.>, the standard sample data will be deleted. If you have selected one of these items by mistake, you can cancel by pressing [RETURN].

If you press [ENTER], the standard sample data settings will be deleted.

**<1. Scanning range>**

Set the wavelength range over which the absorbance will be measured.

**<2. Rec. range>**

Enter the range for the vertical axis when displaying the absorption spectrum on screen for a standard sample measurement or unknown sample measurement.

**<3. Scan speed> (Fast, Medium, Slow, Very Slow)**

Set the wavelength scanning speed from among 4 levels.

**<4. Display mode>**

Select whether to overlay absorption spectra for standards or unknown samples, or rewrite the spectrum for each measurement.

**<5. No. of components>**

Enter the number of components that comprise the mixed sample. The entry range is 2 to 8 components.

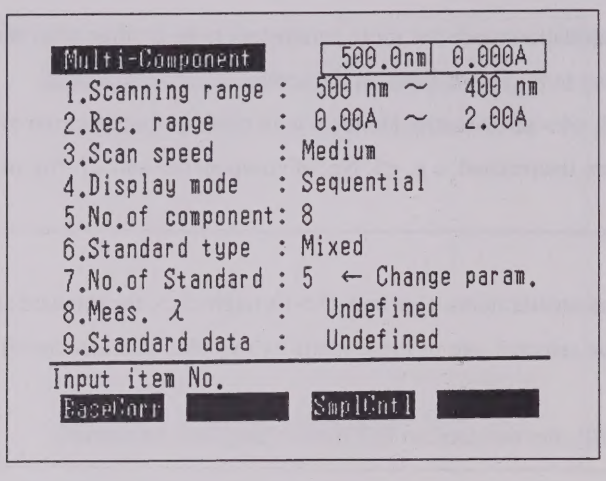



**Fig. 8.4 No. of components entry screen**

The number of constituent components is related to both <6. Standard type> and <7. No. of Standard>.

If it becomes necessary to change the No. of standards because there has been a change in the No. of components, you will be instructed on screen to "Change param."

In addition, if <6. Standard type> is set to "Pure", <7. No. of Standard> will automatically be overwritten with the same number as the No. of components.

**<6. Standard type>**

Select a number to indicate whether the standard sample is a pure sample made from a single component or a mixed sample of known concentrations of more than one component.

**<7. No. of Standard>**

Enter the number of standard samples. If the standard is pure, the No. of standard samples will automatically be set to the same number as the No. of components.

When the standard sample is a mixed sample, the input range is (No. of components + 1) to 16.

**<8. Meas λ >**

Select the wavelength for measurement of standards and unknowns. The concentration of the sample will be calculated from the absorbance at specified measurement wavelengths in the spectrum.

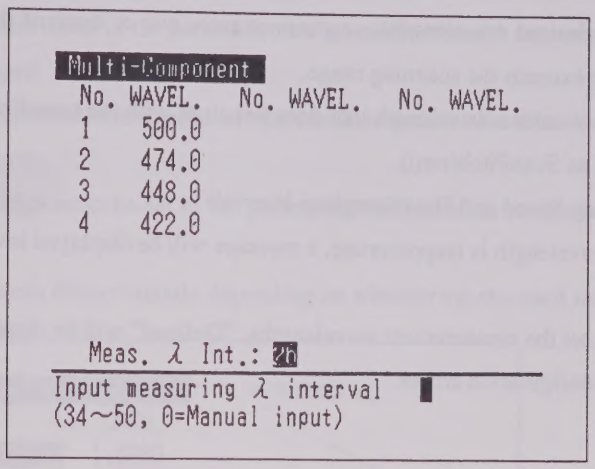



**Fig. 8.5 Measurement wavelength input screen**

You can enter wavelengths by setting an equal interval using the starting wavelength (long wavelength) as a standard or by numerically entering any desired wavelength values. Key in the wavelength interval or the number of desired wavelengths and their values as instructed on the screen. The input screen for entering desired wavelengths is shown below.

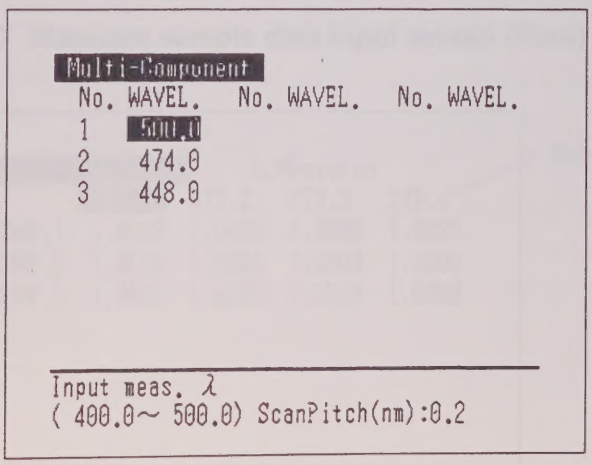



**Fig. 8.6 Desired wavelength input screen**

The numbers of wavelengths which can be specified are as follows.

For pure samples: Only the same number as (No. of components)

For mixed samples: (No. of components) ~ (No. of standard - 1)

When entering desired wavelengths, you cannot enter two or more of the same wavelength, or a wavelength that exceeds the scanning range.

You also may not enter a wavelength that does not align with the sampling pitch of the wavelength scan (displayed as ScanPitch(nm)).

(see 4.6 Scanning Speed and Data Sampling Interval)

If the entered wavelength is inappropriate, a message will be displayed inviting you to enter another wavelength.

Once you have set the measurement wavelengths, "Defined" will be displayed in <8. Meas. λ > of the parameter configuration screen.

**<9. Standard data>**

This allows you to enter the standard sample concentrations, after that to measure the standard sample absobance spectra.

This parameter is explained in "7.4 Measuring Standard Sample".

# 8.4 Measurement Standard Samples

When you select <9. Standard data> in the parameter configuration screen, a standard sample concentration input screen will be displayed.

The standard sample concentrations are entered and the standard sample absorbance spectra are measured in this screen.

Parameters <1.> through <8.> must be set in the parameter configuration screen in order to measure the standard sample(s).

The concentration input screen differs slightly depending on whether the standard sample is pure or mixed.

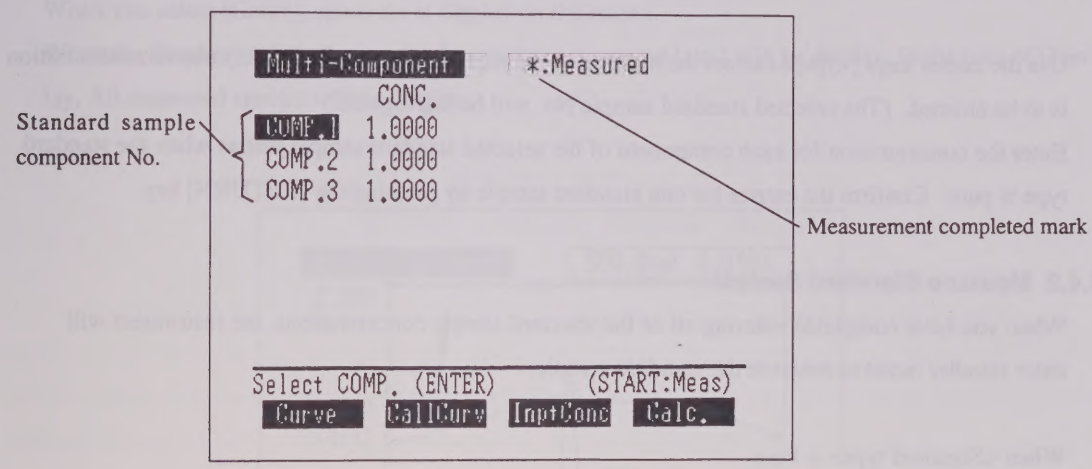



**Fig. 8.7 Standard sample data input screen (Pure)**

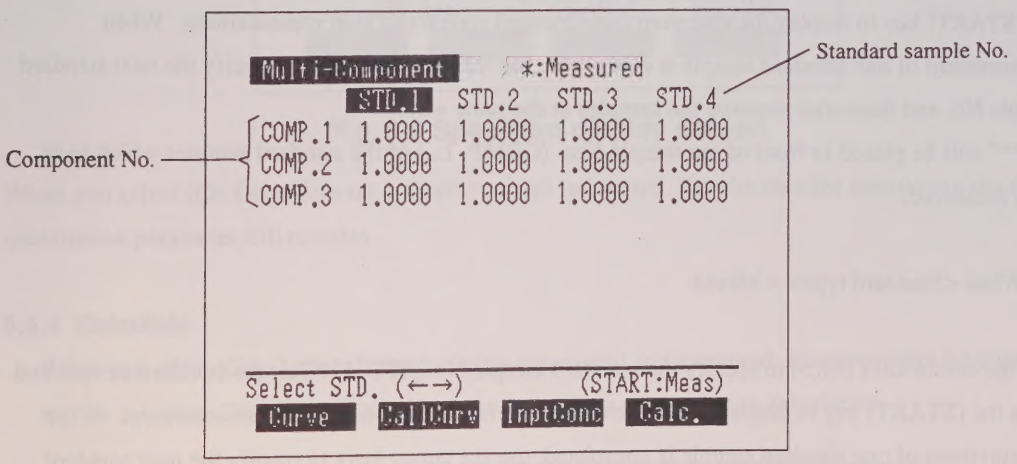



**Fig. 8.8 Standard sample data input screen (Mixed sample)**

### 8.4.1 Enter Concentration [InptConc]

When <Standard type> = Pure

When you select [InptConc], the concentration column (CONC.) for each standard (COMP. 1...) will be highlighted in order. Key in the concentrations in order as instructed on the screen. Confirm the entered concentration value with the [RETURN] key.

When <Standard type> = Mixed

Use the cursor keys [<][>] to select the number of the standard sample (STD. 1...) whose concentration is to be entered. (The selected standard sample No. will be highlighted.)
Enter the concentration for each component of the selected standard sample just as when the standard type is pure. Confirm the entries for one standard sample by pressing the [RETURN] key.

### 8.4.2 Measure Standard Sample

When you have completed entering all of the standard sample concentrations, the instrument will enter standby mode to measure the standard sample.

When <Standard type> = Pure

Use the [ENTER] key to specify standard sample No. (COMP. 1...), set the standard sample and press the [START] key to display the spectrum measurement screen and start measurement. When measurement of one standard sample is completed, use the [ENTER] key to specify the next standard sample No. and thereafter measure the samples in the same way.
An "*" will be placed in front of the sample Nos. (COMP. 1...) of the standard samples which have been measured.

When <Standard type> = Mixed

Use the cursor keys [<][>] to specify the standard sample No. (STD. 1...), set the standard sample and press the [START] key to display the spectrum measurement screen and start measurement. When measurement of one standard sample is completed, use the cursor keys to specify the next standard sample No. and thereafter measure the samples in the same way.
An "*" will be placed in front of the sample Nos. (STD. 1...) of the standard samples which have been measured.

[CallCurv]

Whether the sample is pure or mixed, you can call up absorbance spectrum measured in the Spectrum mode which have already been saved in memory and use them as the standard sample data.

Specify the standard sample No. just as when performing measurement, and then call the spectrum from memory with [CallCurv] (See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv]).

### 8.4.3 Display Curve

When you select [Curve], spectrum is display on the screen.

When the Display mode is Sequential,the spectrum measured latest will be display. In the case of Overlay, All measured spectra will be display.

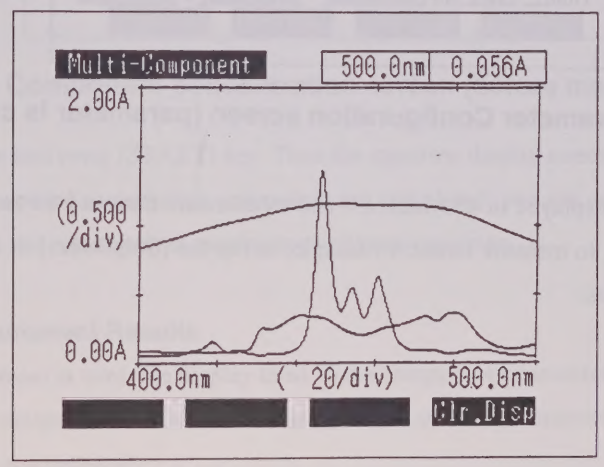



**Fig. 8.9 Spectrum display screen**

When you select [Clr.Disp],Spectra is displayed will be cleared. But the data for calculating the isolation quantitation parameter still remains .

### 8.4.4 Calculate

When you select [Calc.] after all standard data are entered and measured, the parameters for quantitation will be calculate. "Busy" is displayed on the upper right corner during calculation.

**Note**:When you execute the calculation, the measured spectrum will be deleted.

The result of calculation is confirmed by entering [RETURN] key. After that Parameter Configuration screen will be displayed.

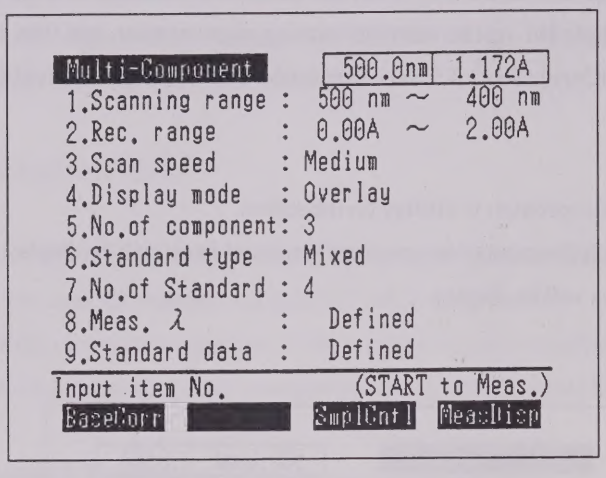



**Fig. 8.10 Parameter Configuration screen (parameter is confirmed)**

When "Defined" is displayed in <8.Meas. λ > and <9.Standard data> of the parameter configuration screen, you can start to measure unknown samples using the [SmplMeas] or the [START] key and perform measurements.

After you finish setting quantitation parameters, push [MeasDisp] key to switch the measurement parameter configuration screen into the component concentration screen.

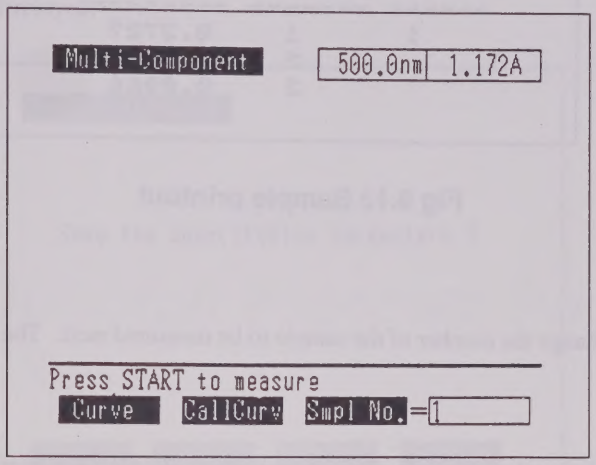



**Fig 8.11 Component concentration screen (before measurement)**

Set an unknown sample and press [START] key. Then the spectrum display screen comes up and the measurement begins.After setting quantitation parameters are completed, you can start the measurement by hitting [START] key in the measurement parameter configuration screen.

### 8.5.1 Display Measurement Results

When the measurement is over, the display turns to the component concentration screen, and the concentration of each component in the unknown sample. If a printer is connected to the instrument, the result is printed out automatically.

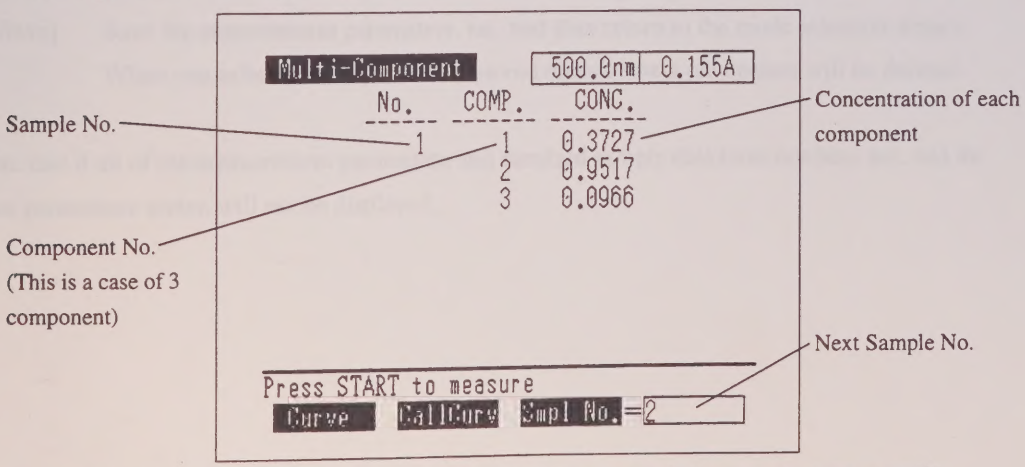



**Fig 8.12 Component concentration screen (after measurement)]**

| No. | COMP. | CONC. |
|---|---|---|
| 1 | 1 | 0.3727 |
| | 2 | 0.9517 |
| | 3 | 0.0966 |

**Fig 8.13 Sample printout**

[Smpl No.]

This allows you to change the number of the sample to be measured next. The input range for sample No. is 0 to 9999.

[Curve]

This allows you to display the spectrum of an unknown sample which has been measured. (See 7.4.3 Display Curve [Curve])

[CallCurv]

This allows you to call up the spectrum of an unknown sample which has been saved in memory and perform quantitation. (See 7.4.2 Measure Standard Sample)

# 8.6 End

When you press the [RETURN] key, the screen returns to the parameter configuration screen. Furthermore, when you press the [MODE] key, the screen for saving measurement parameters and standard sample data is displayed.

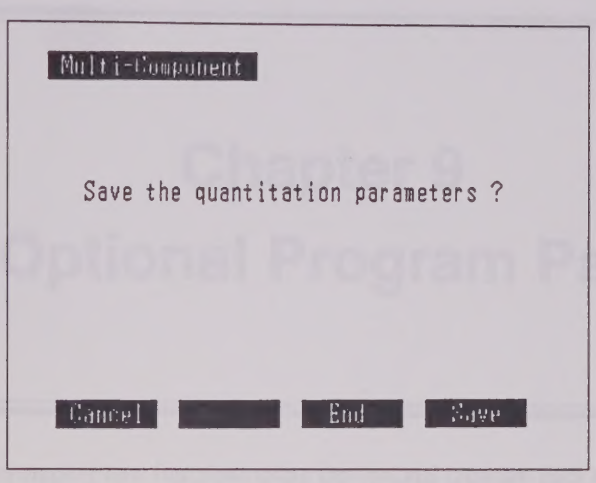



**Fig.8.14 Save parameter screen**

Only one set of measurement parameters and standard sample data can be saved in a different memory area from the measurement parameters of other measurement modes.
(Standard sample data which are saved are only those data which are required for multi-component quantitation. Spectra cannot be saved.)

[Cancel] : Return to the parameter configuration screen without saving the measurement parameters, etc.
[End] :Return to the mode selection screen without saving the measurement parameters, etc.
[Save] :Save the measurement parameters, etc. and then return to the mode selection screen.
When you select [Save], previously stored measurement parameters will be deleted.

Note that if all of the measurement parameters and standard sample data have not been set, and the save parameters screen will not be displayed.

# Chapter 9
# Optional Program Pack

The UV-1601 can employ new functions using the optional program pack (IC card).

CONTENTS

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9.2 Optional Program Pack Auto-start ..... 9-2

# 9.1 Starting the Optional Program Pack

Insert the optional program pack into the IC card slot in the right side of the UV-1600 chassis and then select <7. Optional Program Pack> in the mode selection screen to start the optional program.
If the optional program pack is not inserted properly, the messages "No valid pack" or "No valid program pack" "Insert program pack then press 'ENTER'" will be displayed.

## 9.2 Optional Program Pack Auto-start

If <1. Start program> in the <8. Utilities> mode of the mode selection screen has been set to "Optional Program Pack", a program pack which is inserted into the IC card slot while the power is ON will automatically be started. If the optional program pack is improperly inserted in this condition, the messages "IC card is not properly installed!" "Set program pack and press 'ENTER'" will be displayed.

# Chapter 10 Utilities Mode

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# Chapter 10 Utilities Mode

# 10 Utilities Mode

This is the mode for setting the instrument's operating parameters, such as the light source switching wavelength, printer setup or the number of data columns displayed.
The parameters which can be set in this mode are parameters which are shared with other modes.
These will also be stored internally, even if the power is turned OFF.

# 10.1 Utilities Menu Screen

When you select <8. Utilities> in the mode selection screen, the utilities menu shown in Figure 10.1 will be displayed.

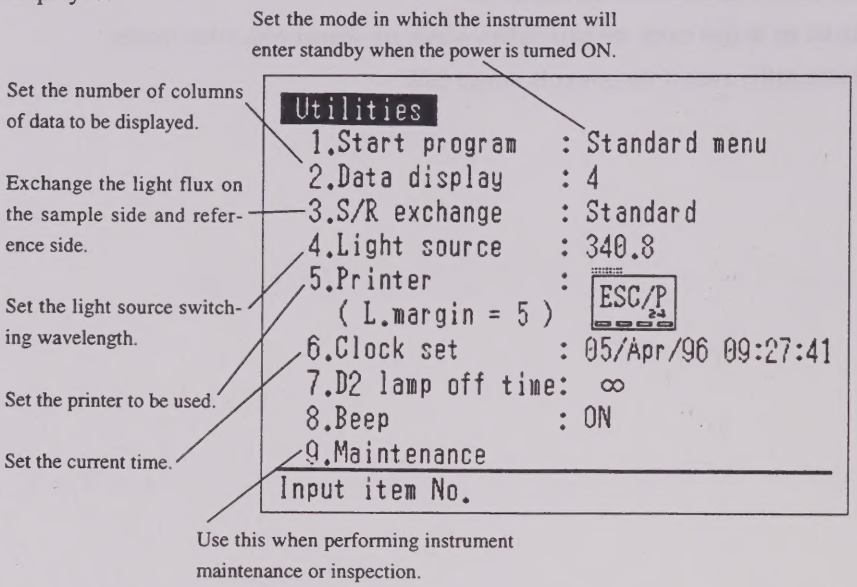
Set the mode in which the instrument will enter standby when the power is turned ON.
Set the number of columns of data to be displayed.
Exchange the light flux on the sample side and reference side.
Set the light source switching wavelength.
Set the printer to be used.
Set the current time.
Use this when performing instrument maintenance or inspection.
Utilities
1.Start program : Standard menu
2.Data display : 4
3.S/R exchange : Standard
4.Light source : 340.8
5.Printer :
( L.margin = 5 )
ESC/P
6.Clock set : 05/Apr/96 09:27:41
7.D2 lamp off time: ∞
8.Beep : ON
9.Maintenance
Input item No.

**Fig. 10.1 Utilities menu screen**

**<1. Start program>**

This function determines the mode in which the instrument will be in after the power is turned ON and initialization is completed. Select the item with the cursor key◀or▶.

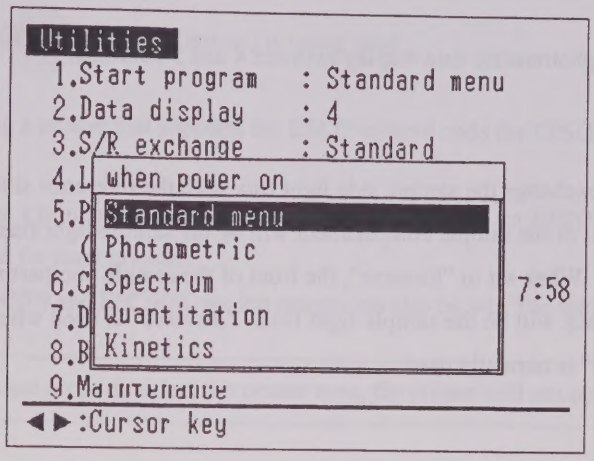


**Fig. 10.2 Start program selection screen**

(1) Standard menu

The instrument is set to this mode for shipping. The mode selection screen will be displayed when the power is turned ON.

(2) Photometric, Spectrum, Quantitation, Kinetics, and Multi-Component

The instrument will stand by at the parameter configuration screen of the selected mode.

(3) Data processing

Stands by at the processing item selection screen.

(4) Optional program pack

The program pack inserted in the slot will automatically start. If the program pack is not properly inserted into the slot, the messages "No valid pack" or "No valid program pack" "Insert program pack then press 'ENTER'" will be displayed.

(5) Stored param. file

The measurement parameter file stored in instrument memory and set here will be called up and the instrument will go to standby.

Saving Measurement Parameters...

Save measurement parameters to a file by pressing the [SavParam] function key in the measurement parameter configuration screen for the respective mode.

See "2.3.4 Save Parameters [SavParam]" for more details.

(6) PC control

The instrument automatically goes to the PC control mode. (See 12 PC control)

**<2. Data display>**

You can switch the photometric data display between 4 and 5 columns.

**<3. S/R exchange>**

This allows you to exchange the sample side light flux with the reference side light flux. When set to "Standard", the front of the sample compartment will be the sample light flux and the back will be the reference light flux. When set to "Reverse", the front of the sample compartment will be the reference light flux and the back will be the sample light flux. "Reverse" is used when special accessories are installed. "Standard" is normally used.

**<4. Light source>**

The UV-1601 uses an ultraviolet deuterium lamp (D2 lamp) and a visible-nearinfrared tungsten-iodine lamp (WI lamp). The switching wavelength for these two lamps is set to 340.8nm at the time of shipping, but it can be set to any value between 295.0 and 364.0nm.

**<5. Printer setting>**

The printer to be connected is selected and the format of a hard copy is set.



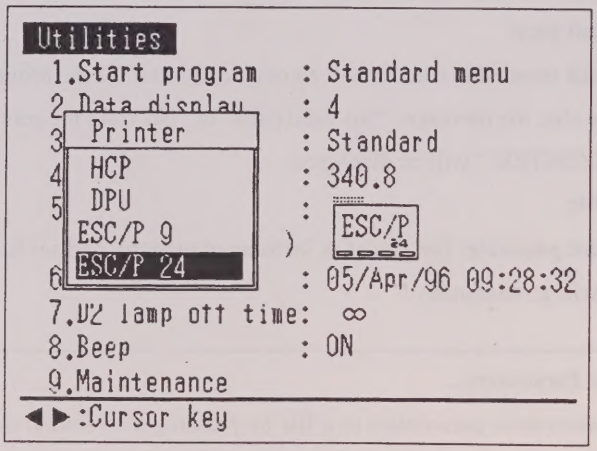


**Fig. 10.3 Printer selection screen**

(1) Following four types of printers can be connected.

HCP

Set this when the screen copy printer HPC-1A (option) is being used.

DPU

Set this when the DPU-411 printer (option) is being used.

ESC/P9

Set this when using a printer that supports the ESC/P control code for EPSON 9-pin printers.

ESC/P24

Set this when using a printer that supports the ESC/P control code for EPSON 24-pin printers.

This is also applied for laser printers.

When selecting ESC/P9 and ESC/P24, the left margin can also be set. The setting range is from 0 to 9.

NOTE! If you do not properly select the printer type, the printer will not operate properly.

(2) Date print

Set this whether the date should be printed in the hard copy output.

(3) Function key print

Set this whether the region to display function keys should be output in a hard copy.

**<6. Clock set>**

Use this to set the time of the clock. The clock is the 24-hour type and is set in the order (Year/Month/Date Hour: Minute:Second). Since it has a battery back-up, it is not necessary to set the clock every time you turn ON the power.

Ex.) 10/Dec/94 12:34:56

**<7. Turning OFF the D2 lamp automatically>**

D2 lamp is automatically turned OFF when measurement is not performed. The following 4 kinds of time are available for OFF timer setting. When nothing is executed during the set time, the lamp is turned OFF.

10 min, 30 min, 60 min, ∞

**<8. Buzzer sound>**

Set this to turn ON/OFF of the buzzer.

**<9. Maintenance>**

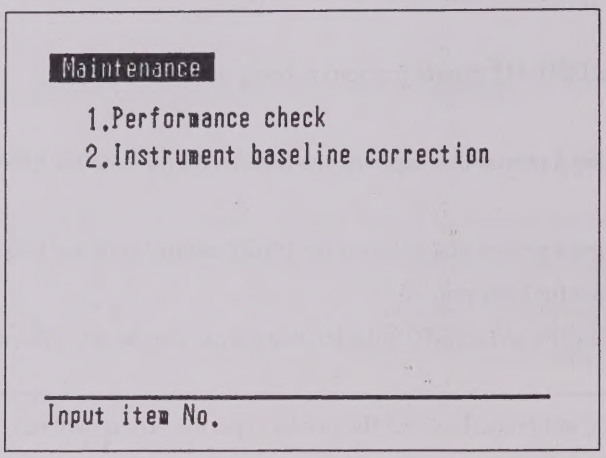


**Fig. 10.4 Instrument maintenance and inspection screen**

(1) Performance check

This runs a performance check of the spectrophotometer regarding the following items and the results are displayed with the date and instrument serial number. The same information will automatically be printed out if there is a printer connected.

1) Wavelength accuracy

Measures the emission line of the D2 lamp (656.1nm, 486.0nm) to find the difference between those peak wavelengths.

2) Repeatability of wavelength setting

Measures the emission line of the D2 lamp (656.1nm, 486.0nm) 3 times to find the variance in those results.

3) Resolution

Finds the half width of the emission line of the D2 lamp.

4) Initialize

Prints the initialization results when the power was turned ON. (In this function, the initialization operation is not performed.)

```
*****        C H E C K        *****

Date : 93/12/21 19:36:23

Serial No. : 1993-12-20

Wavelength accuracy

        656.1nm          486.0nm
    1   656.2     0.1    485.9    -0.1
    2   656.2     0.1    486.0     0.0
    3   656.1     0.0    485.9    -0.1
   ---------------------------------
Repeatability    0.1              0.1
of wavelength
Setting

Resolution :  1.91

Initialize

   LSI INITIALIZE                  : OK
   MEMORY ROM CHECK                : OK
   MEMORY RAM CHECK                : OK
   FILTER MOTOR INITIALIZE         : OK
   LIGHT MOTOR INITIALIZE          : OK
   SCAN MOTOR INITIALIZE           : OK
   WI ENERGY CHECK                 : OK
   WAVELENGTH ORIGIN 1 SEARCH      : OK
   D2 ENERGY CHECK                 : OK
   WAVELENGTH ORIGIN 2 SEARCH      : OK

      SHIMADZU Corporation Kyoto Japan
```

**Fig. 10.5 Function check results printout**

(2) Instrument baseline correction

In addition to normal baseline correction, this instrument also has an instrument baseline correction function. Instrument baseline correction corrects and records the optical balance of the spectrophotometer itself at narrow correction intervals. The recorded instrument baseline is then used during baseline correction in the various measurement modes. The baseline correction in each of the modes performs correction at a relatively coarse correction interval over a specified wavelength range, but is also able to correct even fine optical imbalances in the instrument in a short time. If the correction measurements in this correction are not performed at the same intervals as the data acquisition interval used during measurement in a past baseline correction, differences and shock noise which could not be corrected can be eliminated.

Since the instrument baseline changes due to time-dependent changes in the instrument, it is recommended that you perform instrument baseline correction during periodic inspections (once per month) or when the flatness of the baseline is especially poor. When a special accessory has been used which restricts the light flux in the sample module, etc., sufficient baseline correction results will be obtained by performing instrument baseline correction once and then performing baseline correction in the various modes starting from the next time the instrument is used.

# Chapter 11
# Data Processing Mode

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# 11 Data Processing Mode



In this mode, the following 5 processing functions can be performed on wavelength and time scanning data measured in the Spectrum and Time Scan (only 1-cell measurement) modes.

**<1. CH operation>**

Enables arithmetic operations with curve data and numerical value, and arithmetic operations between curve data with matching vertical axis units (ABS, T%, E) and horizontal axis units (nm, sec, min).

**<2. Derivative>**

Perform derivative processing on curve data.

Enables you to set the wavelength difference $\Delta\lambda$ or time difference $\Delta T$ for the derivative calculations, and perform 1st to 4th order derivative processing.

You can also perform smoothing processing by setting 0 (zero) as the derivative order.

**<3. Peak>**

Enables the peaks and valleys in a curve data to be detected and a table of the numeric values to be displayed. Up to 20 peaks and valleys can be detected.

**<4. Area calc.>**

Calculates the area bounded by the curve and horizontal axis.

The calculated area inside and outside the curve will be displayed.

**<5. Point pick>**

Enables the ordinate values corresponding to the abscissa values specified with arbitrary or a fixed interval to be displayed in a numeric table. Up to 20 points can be displayed.

**NOTE!**

In this mode, files in which curve data are saved can be expressed with CH (channels).

# 11.1 Processing Item Selection Screen



When F2 key is pressed in the spectrum/time scan (only in 1-cell measurement) measurement screen, the processing item selection screen shown below will be displayed.

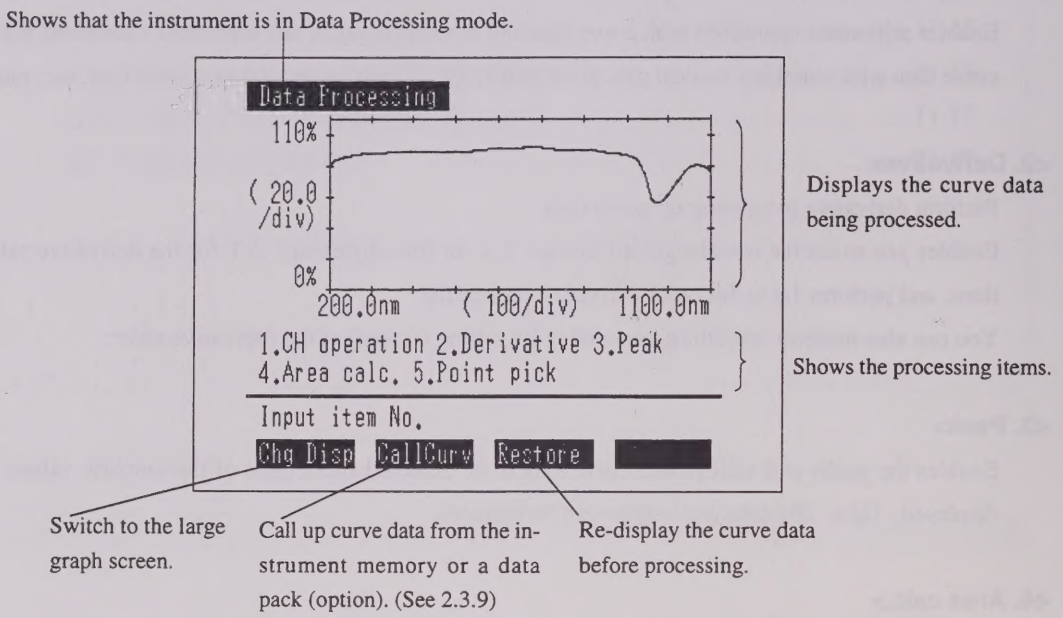



**Fig. 11.1 Processing item selection screen**

### 11.2.1 Select Processing Item

Select the processing item from among the item numbers <1. CH operation> through <5. Point pick> in the processing item selection screen.

### 11.2.2 Select Processing Data

Once measurement has been performed in the Spectrum or Time Scan (only 1-cell measurement) mode and you select [DataProc] F2 key, the data which have just been measured will be displayed in the processing item selection screen, where you can perform data processing on those data.

If you wish to process data which have been stored in the instrument memory or a data pack (option), use [CallCurv] to specify the file No. and call the curve data to the processing item selection screen. (See 2.3.9)

**NOTE!**

The [CallCurv] key does not have an overlay function in Data Processing mode.

### 11.2.3 Change Screens [Chg Disp]

This displays the curve data which have been displayed in the processing item selection screen over the entire screen.

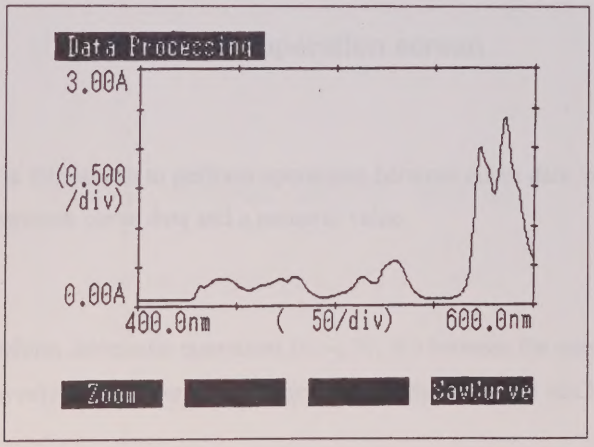



**Fig. 11.2 Switched screen**

The curve data can be zoomed ([Zoom]) in this screen (See 2.3.12 [Zoom]). You can also save the displayed data using [SavCurve] (See 2.3.8 Save Curve/Call Curve [SavCurve]/[CallCurv]).
You can also use the cursor to read any curve data value on the vertical axis (See 2.3.14 Cursor Functions).

**NOTE!**
There is no [Restore] function for [Zoom] in the Data Processing mode (See 2.3.12 Enlarge/Reduce [Zoom]).
The original data can be re-displayed using [Restore] in the processing item selection screen.

Press the [RETURN] key to return to the processing item selection screen.
At this time, the curve data showing the results of data processing (including [Zoom]) will be displayed in the curve data display area of the processing item selection screen.

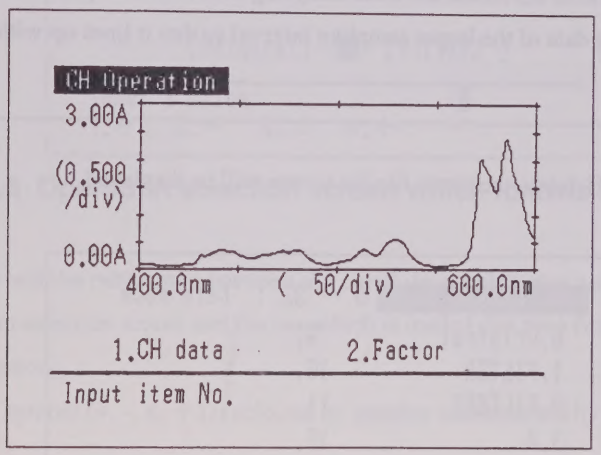
### 11.2.4 [Restore]

You can display the screen with the data before data processing.
Use this to perform a different process, or to redo processing, on the original data.

**<1. CH operation>**

This allows you to perform arithmetic operations (+, –, ×, ÷) between the curve data displayed in the processing item selection screen and another curve called up from instrument memory or a data pack (option) or some numeric value.

When you select <1. CH operation> in the processing item selection screen, the CH operation screen will be displayed.




Original data

**Fig. 11.3 CH operation screen**

Select <1. CH data> in this screen to perform operations between curve data, or select <2. Factor> to perform operations between curve data and a numeric value.

<1. CH data>

This allows you to perform arithmetic operations (+, –, ×, ÷) between the curve data being displayed in the processing item selection screen and the curve data in the specified file No.

**NOTE!**

The units on the vertical axes (ABS, T%, E) of the two curves must be the same. If the ranges of the horizontal axes differ, the operation will be performed for the area in which the ranges overlap. Where (Absorbance data over 500 to 600nm) + (Absorbance data over 550 to 650nm) is specified, the operation will be performed and the results shown for the 550 to 600nm range.

Furthermore, if the sampling interval for the two sets of data differ (See 4.6 Scanning Speed and Data Sampling Interval or 6.3 About the Data Sampling Interval), the operation will be performed after the interpolating data of the larger sampling interval so that it lines up with the smaller sampling interval.

When you select <1. CH data>, the curve file list screen will be displayed.

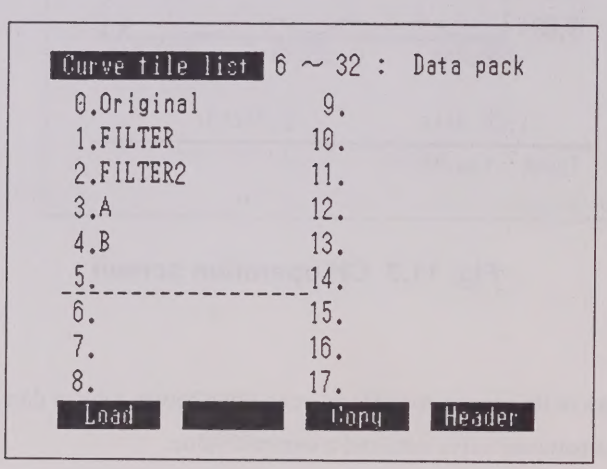
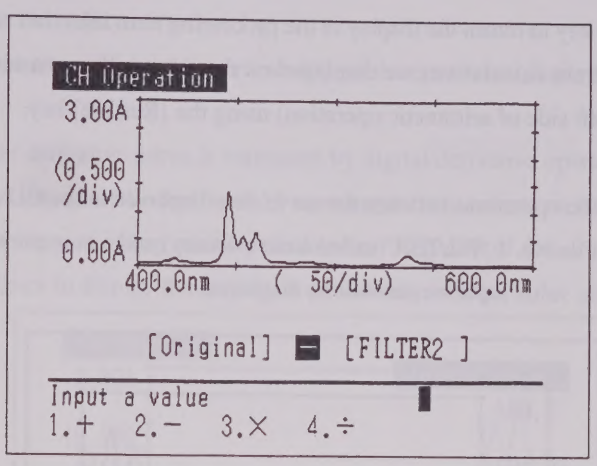



**Fig. 11.4 Curve file list screen**

Specify the file No. for the curve data by the same operation used for [CallCurv] (See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv]). The specified curve data (in this case, file No. 2 "FLTER2") will be displayed on the arithmetic processing screen. In addition, the filename will be displayed on the right side of the screen.

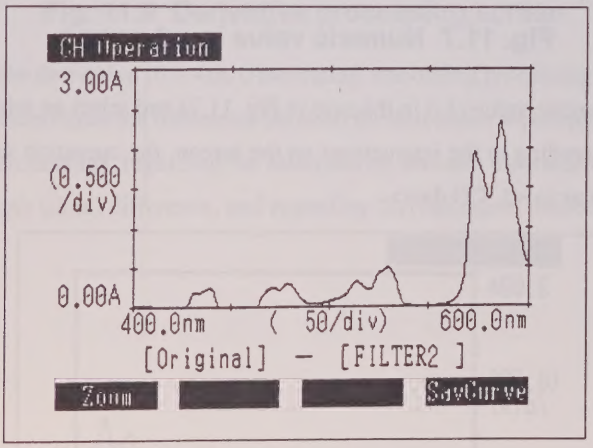



Data from "FILTER2"

**Fig. 11.5 Operation selection screen which follows the curve call.**

The operation will be performed between the curve data which was already being displayed in the processing item selection screen and the one which is loaded this time from the instrument memory or a data pack (option).

The operation symbol (+, -, x, ÷) is selected by number as instructed by the screen.



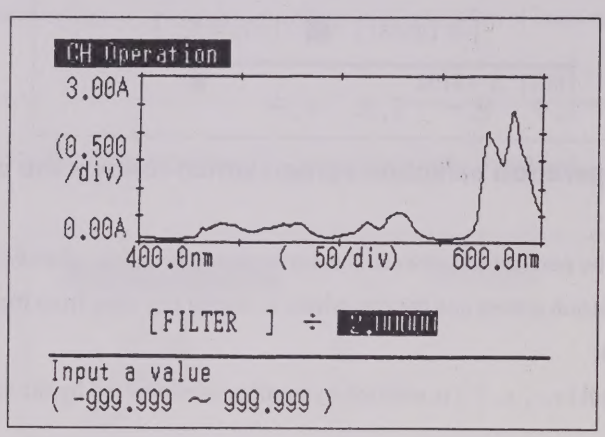

**11.6 Arithmetic Results Display screen**

In this screen, you can save to memory curve data resulting from [Zoom] (See 2.3.12 Zoom [Zoom]) and from calculation results (See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv]).

Press the [RETURN] key to return the display to the processing item selection screen. At this time, the curve data resulting from calculations are displayed on the screen. You can re-display the curve data before processing (Left side of arithmetic operation) using the [Restore] key.

<2. Factor>

This executes arithmetic operations between the curve data displayed in the CH operation screen (in the case of Fig. 11.7, the File No. 1 "FILTER" called from memory) and a numeric value. When you select <2. Factor>, a numeric value input screen will be displayed.




File No. 1 "FILTER"

**Fig. 11.7 Numeric value input screen**

When you enter a numeric value (1.0 in the case in Fig. 11.7) and select an arithmetic symbol (- in the case in Fig. 11.7) according to the instructions on the screen, the operation will be executed and the results displayed just as in <1. CH data>.

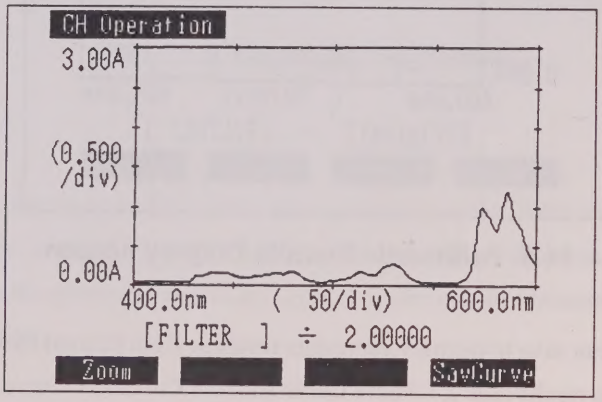



**Fig. 11.8 Operation results display screen**

Operation after this is the same as in <1. CH data>.

**<2. Derivative>**

This performs derivative or smoothing processing on the curve data displayed in the processing item selection screen.

The 1st to 4th order derivative curve is computed by digital derivative operation processing using the convolution method, based on the data from 17 wavelength (time) points on either side of the curve data. In addition, smoothing processing can be performed on 17 points of data.

Select <2. Derivative> to display the derivative processing screen.

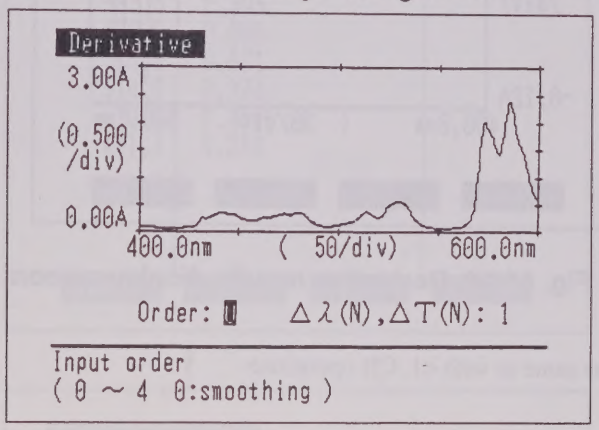



**Fig. 11.9 Derivative processing screen**

Enter the order of the derivative (0 ~ 4th, 0 indicating smoothing processing) and the coefficient Δ λ (N) or Δ T(N) that determines the difference between the derivative wavelengths (times). Refer to "11.4 About Derivative Processing" regarding the relationship between the value of this coefficient and the derivative wavelength (time) difference, and regarding derivatization, smoothing, etc.

The results from the derivative of the curve data displayed in the derivative processing screen where ORDER=2 and $\Delta\ \lambda$ (N)=1, are shown in Figure 11.10.

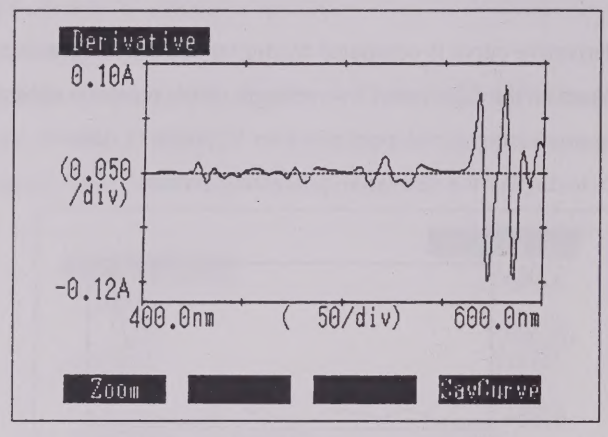
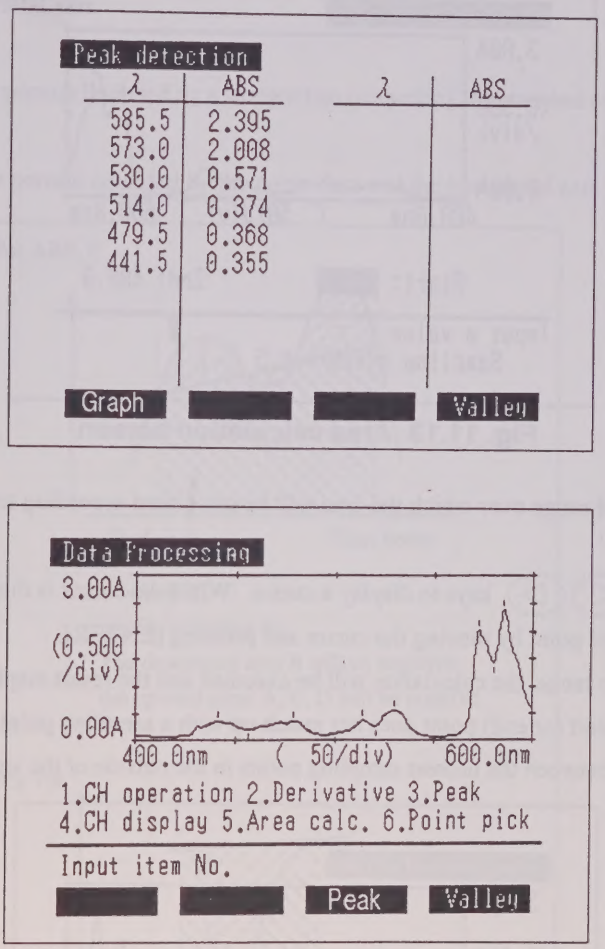



**Fig. 11.10 Derivative results display screen**

Operation after this is the same as with <1. CH operation>.

### <3. Peak detection>

This detects the peaks or valleys in the curve data displayed in the processing item selection screen and displays a list of the results. When selecting [Peak] or [Valley], the peak table shown in Fig. 11.11 is changed over. Up to 20 peaks, valleys can be detected.




(Peak table)

Peak/valley mark

(Peak/valley marks)

**Fig. 8.11 Peak detection screen**

When selecting [Graph] in the Peak detection screen, the curve data with the mark indicating peaks and valleys will be displayed. When you press the [RETURN] key on the Peak detection screen, the data before peak detection (without mark) will be displayed.

### <4. Area calc.>

This calculates the area bounded by the curve and the horizontal axis.

When you select <4. Area calc.>, the area calculation screen will be displayed (Fig. 11.13)

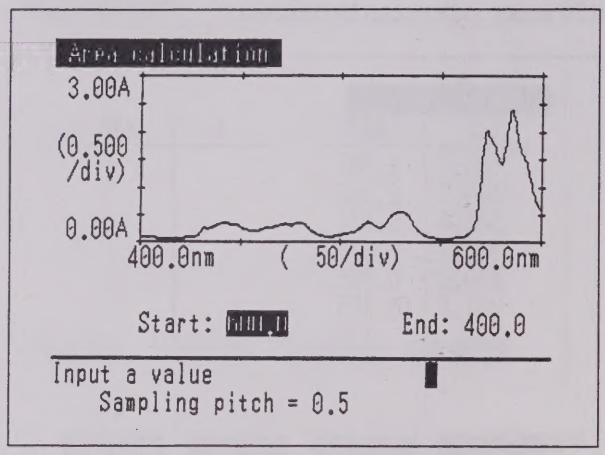



**Fig. 11.13 Area calculation screen**

Enter the horizontal range over which the area will be calculated according to the instructions on the screen.

Press one of the ◁ ▷ keys to display a cursor. While the cursor is displayed, you can specify the start point or end point by moving the cursor and pressing [ENTER].

When you enter the range, the calculation will be executed and the result displayed. (Fig. 8.16)

If the value at the start (or end) point does not match up with a sampling point, the calculation will be performed between the nearest sampling points in the outside of the specified range.

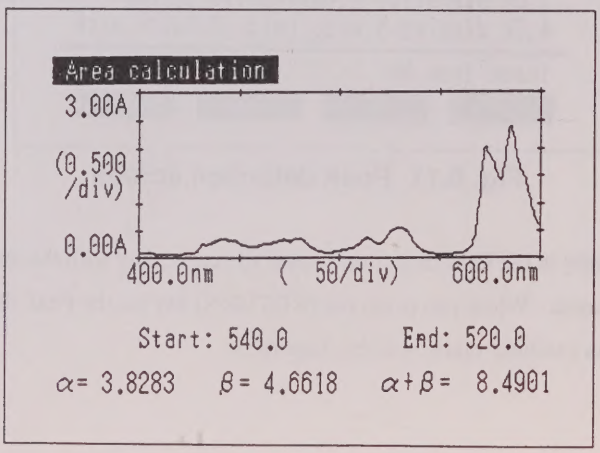



**Fig. 11.14 Calculation results display screen**

The calculation results are expressed as the values for $\alpha$, $\beta$ and $\alpha+\beta$. For ABS, E:

$\alpha$ = the area of the portion bounded by the curve data and a straight line connecting the start and end points on the data

$\beta$ = the area of the portion bounded by a straight line connecting the start and end points on the curve data and the horizontal axis.

For T%:

$\alpha$ = the area of the portion bounded by a straight line connecting the start and end points on the data and the curve data

$\beta$ = the area of the portion bounded by the curve data and the horizontal axis.

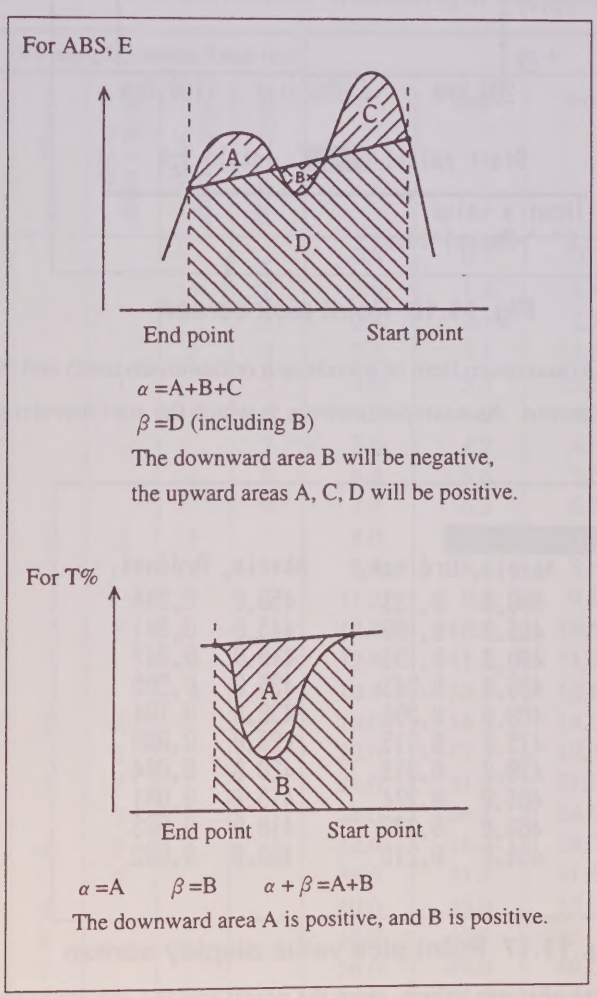



**Fig. 11.15 Area calculation schematic diagram**

Press the [RETURN] key to return to the processing item selection screen.

### <5. Point pick>

This will display a list of ordinate data for up to 20 points at a specified interval from a specified abscissa (wavelength, time). Inputting "-" for the start point of abscissa enables the ordinate data corresponding to up to 20 points of arbitrary abscissa values to be displayed.When you select <5. Point pick>, the point pick screen will be displayed.

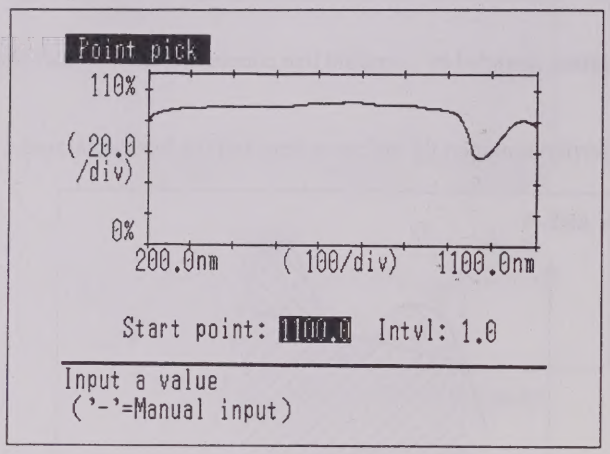



**Fig. 11.16 Point pick screen**

Enter the starting abscissa (maximum limit of wavelength or minimum time) and the interval according to the instructions on the screen. An example is shown in which the start wavelength is 500nm and the interval is 5nm.

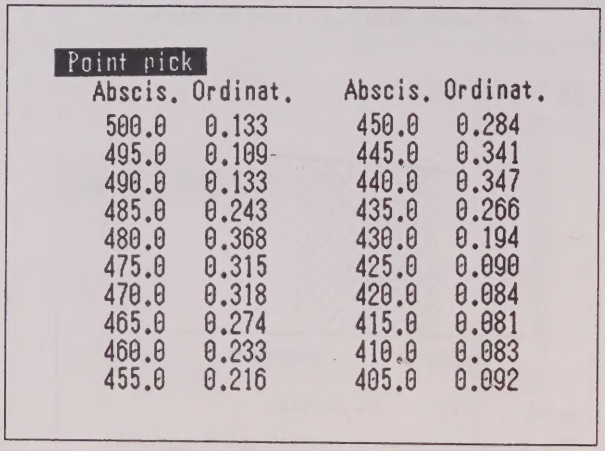



**Fig. 11.17 Point pick value display screen**

When arbitrarily inputting abscissa values, input the points and the abscissa values for those points according to the instruction on the screen.

Press the [RETURN] key to return to the processing item selection screen.

### 11.4.1 Derivative Wavelength (Time) Difference

The derivative wavelength difference $\Delta\lambda$ or derivative time difference $\Delta T$ is determined by the value for the wavelength (time) range of the curve data and the value for $\Delta\lambda$ (N) or $\Delta T$(N) which is keyed in. This relationship is illustrated in tables 11.1 and 11.2. Generally, the noise decreases and the amplitude of the derivative spectrum increases as the value for $\Delta\lambda$ or $\Delta T$ is greater, but the resolution of the derivative spectrum curve deteriorates if the value is too great. Determine $\Delta\lambda$ and $\Delta T$ taking noise and resolution into consideration.

**Table 11.1 Correlation between the input value for $\Delta\lambda$ (N) and the derivative wavelength difference $\Delta\lambda$**

| | Wavelength Scanning Range (nm) | | | | $\Delta\lambda$ | | | |
|---|---|---|---|---|---|---|---|---|
| | $\lambda$ range $>500$ | $500 \geqq \lambda$ range $>200$ | $200 \geqq \lambda$ range $>100$ | $100 \geqq \lambda$ range | 1st | 2nd | 3rd | 4th |
| | | | | 1 | 0.8 | 0.7 | 0.7 | 0.6 |
| | | | 1 | 2 | 1.6 | 1.4 | 1.4 | 1.2 |
| | | | | 3 | 2.4 | 2.1 | 2.1 | 1.8 |
| | | | 2 | 4 | 3.2 | 2.8 | 2.8 | 2.4 |
| | | 1 | | 5 | 4.0 | 3.5 | 3.5 | 3.0 |
| | | | 3 | 6 | 4.8 | 4.2 | 4.2 | 3.6 |
| | | | | 7 | 5.6 | 4.9 | 4.9 | 4.2 |
| | | | 4 | 8 | 6.4 | 5.6 | 5.6 | 4.8 |
| | | | | 9 | 7.2 | 6.3 | 6.3 | 5.4 |
| | 1 | 2 | 5 | | 8.0 | 7.0 | 7.0 | 6.0 |
| | | | 6 | | 9.6 | 8.4 | 8.4 | 7.2 |
| | | | 7 | | 11.2 | 9.8 | 9.8 | 8.4 |
| $\Delta\lambda$ (N) | | 3 | | | 12.0 | 10.5 | 10.5 | 9.0 |
| | | | 8 | | 12.8 | 11.2 | 11.2 | 9.6 |
| | | | 9 | | 14.4 | 12.6 | 12.6 | 10.8 |
| | 2 | 4 | | | 16.0 | 14.0 | 14.0 | 12.0 |
| | | 5 | | | 20.0 | 17.5 | 17.5 | 15.0 |
| | 3 | 6 | | | 24.0 | 21.0 | 21.0 | 18.0 |
| | | 7 | | | 28.0 | 24.5 | 24.5 | 21.0 |
| | 4 | 8 | | | 32.0 | 28.0 | 28.0 | 24.0 |
| | | 9 | | | 36.0 | 31.5 | 31.5 | 27.0 |
| | 5 | | | | 40.0 | 35.0 | 35.0 | 30.0 |
| | 6 | | | | 48.0 | 42.0 | 42.0 | 36.0 |
| | 7 | | | | 56.0 | 49.0 | 49.0 | 42.0 |
| | 8 | | | | 64.0 | 56.0 | 56.0 | 48.0 |
| | 9 | | | | 72.0 | 63.0 | 63.0 | 54.0 |

## Table 11.2 Correlation between the input value for ΔT(N) and the derivative time difference ΔT

| | RECORDING TIME (SEC) | | | | | | | Δt (SEC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6500≧T>5000 | 5000≧T>2000 | 2000≧T>1000 | 1000≧T>500 | 500≧T>200 | 200≧T>100 | 100≧T>10 | 1st | 2nd | 3rd | 4th |
| | | | | | | | 1 | 0.8 | 0.7 | 0.7 | 0.6 |
| | | | | | | 1 | 2 | 1.6 | 1.4 | 1.4 | 1.2 |
| | | | | | | | 3 | 2.4 | 2.1 | 2.1 | 1.8 |
| | | | | | | 2 | 4 | 3.2 | 2.8 | 2.8 | 2.4 |
| | | | | | 1 | | 5 | 4.0 | 3.5 | 3.5 | 3.0 |
| | | | | | | 3 | 6 | 4.8 | 4.2 | 4.2 | 3.6 |
| | | | | | | | 7 | 5.6 | 4.9 | 4.9 | 4.2 |
| | | | | | | 4 | 8 | 6.4 | 5.6 | 5.6 | 4.8 |
| | | | | | | | 9 | 7.2 | 6.3 | 6.3 | 5.4 |
| | | | | 1 | 2 | 5 | | 8.0 | 7.0 | 7.0 | 6.0 |
| | | | | | | 6 | | 9.6 | 8.4 | 8.4 | 7.2 |
| | | | | | | 7 | | 11.2 | 9.8 | 9.8 | 8.4 |
| | | | | | 3 | | | 12.0 | 10.5 | 10.5 | 9.0 |
| | | | | | | 8 | | 12.8 | 11.2 | 11.2 | 9.6 |
| | | | | | | 9 | | 14.4 | 12.6 | 12.6 | 10.8 |
| | | | 1 | 2 | 4 | | | 16.0 | 14.0 | 14.0 | 12.0 |
| | | | | | 5 | | | 20.0 | 17.5 | 17.5 | 15.0 |
| | | | | 3 | 6 | | | 24.0 | 21.0 | 21.0 | 18.0 |
| | | | | | 7 | | | 28.0 | 24.5 | 24.5 | 21.0 |
| ΔT(N) | | | 2 | 4 | 8 | | | 32.0 | 28.0 | 28.0 | 24.0 |
| | | | | | 9 | | | 36.0 | 31.5 | 31.5 | 27.0 |
| | | 1 | | 5 | | | | 40.0 | 35.0 | 35.0 | 30.0 |
| | | | 3 | 6 | | | | 48.0 | 42.0 | 42.0 | 36.0 |
| | | | | 7 | | | | 56.0 | 49.0 | 49.0 | 42.0 |
| | | | 4 | 8 | | | | 64.0 | 56.0 | 56.0 | 48.0 |
| | | | | 9 | | | | 72.0 | 63.0 | 63.0 | 54.0 |
| | 1 | 2 | 5 | | | | | 80.0 | 70.0 | 70.0 | 60.0 |
| | | | 6 | | | | | 96.0 | 84.0 | 84.0 | 72.0 |
| | | | 7 | | | | | 112.0 | 98.0 | 98.0 | 84.0 |
| | | 3 | | | | | | 120.0 | 105.0 | 105.0 | 90.0 |
| | | | 8 | | | | | 128.0 | 112.0 | 112.0 | 96.0 |
| | | | 9 | | | | | 144.0 | 126.0 | 126.0 | 112.0 |
| | 2 | 4 | | | | | | 160.0 | 140.0 | 140.0 | 120.0 |
| | | 5 | | | | | | 200.0 | 175.0 | 175.0 | 150.0 |
| | 3 | 6 | | | | | | 240.0 | 210.0 | 210.0 | 180.0 |
| | | 7 | | | | | | 280.0 | 245.0 | 245.0 | 210.0 |
| | 4 | 8 | | | | | | 320.0 | 280.0 | 280.0 | 240.0 |
| | | 9 | | | | | | 360.0 | 315.0 | 315.0 | 270.0 |
| | 5 | | | | | | | 400.0 | 350.0 | 350.0 | 300.0 |
| | 6 | | | | | | | 480.0 | 420.0 | 420.0 | 360.0 |
| | 7 | | | | | | | 560.0 | 490.0 | 490.0 | 420.0 |
| | 8 | | | | | | | 640.0 | 560.0 | 560.0 | 480.0 |
| | 9 | | | | | | | 720.0 | 630.0 | 630.0 | 540.0 |

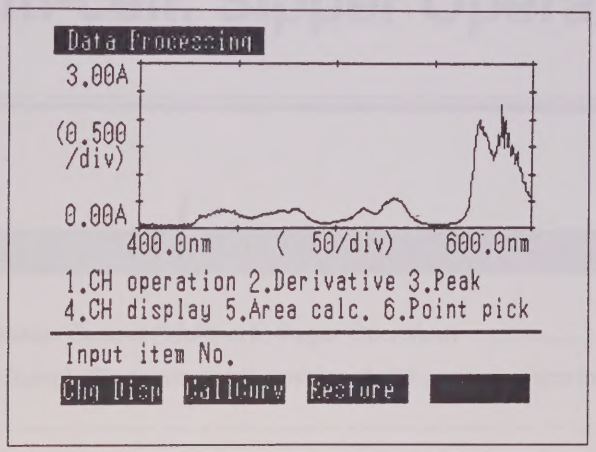
### 11.4.2 Values at Ends of Derivative Spectrum

Since the derivative value is calculated at each wavelength (time) in derivative processing, the data before and after each individual wavelength are required. There are instances in which the derivative values at the ends of the curve data are incorrect because the data for the points required for calculation have to be extrapolated in order to perform the derivative calculations.

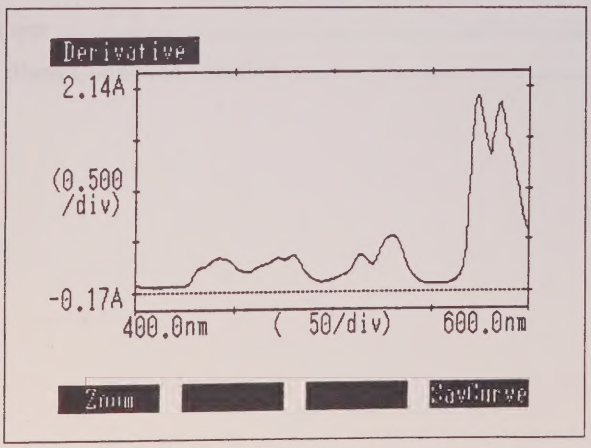
### 11.4.3 Smoothing Processing

Smoothing processing is data processing which uses the same method as derivative processing to reduce the noise in curve data.

An example of smoothing processing is illustrated below. (Figs. 11.18(A), (B))




(A) Before smoothing




(B) After smoothing

**Fig. 11.18 Smoothing processing**

# Chapter 12
# Sample Module Control (Multi-cell, Sipper Operation)

CONTENTS

12 Sample Module Control (Multi-cell, Sipper Operation) ..... 12-1
12.1 Multi-cell Sample Compartment (6-position, 8-/16-position micro multi-cell) ..... 12-2
12.2 CPS-240 ..... 12-4
12.3 Sipper 160 ..... 12-5
12.4 Syringe Sipper ..... 12-6
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# Chapter 12
# Sample Module Control
# (Multi-cell, Slipper Operation)

# 12 Sample Module Control (Multi-cell, Sipper Operation)

When you use a function key to call up the sample control screen from a measurement parameter configuration screen, you can set the measurement parameters for the sample module.

The 5 following accessories are available which can be mounted in place of the standard sample module and operated in synchronization with the main instrument.

1. Multi-cell (Cell holder capable of handling 6 cells.)
2. Micro Multi-cell holder (Cell holder capable of handling 8 or 16-position micro multi-cells.)
3. CPS-240 (6-cell holder with a temperature control function)
4. Sipper 160 (Perform measurements while drawing sample into a flow cell using a pump.)
5. Syringe sipper (Perform measurements while drawing sample into a flow cell using a syringe.)

Refer to “Chapter 5 (Optional) Special Accessories” in the " Instruction Manual - User's System Guide" for the instructions for mounting the various accessories.

This accessory is equipped with max.16 sample-side cell holders and one reference-side cell holder. The sample-side cell holders can be moved automatically or by key operations on the spectrophotometer unit.

The cell holders at the front is numbered 1.

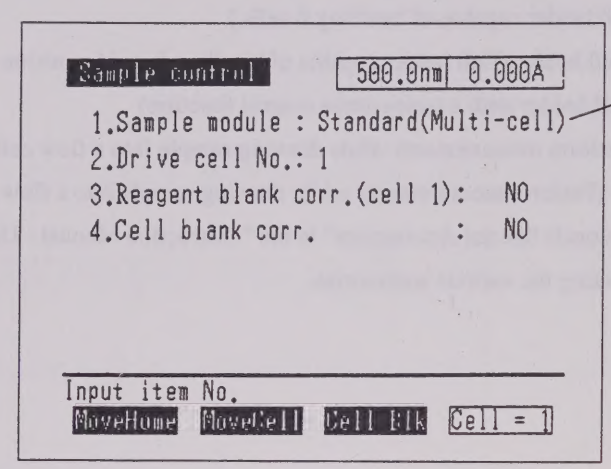


**Fig. 12.1 Sample control screen (6-/8-/16-position multi-cell)**

(1) Sample module

Specify the name of the instrument mounted in the sample module. Select the cell type from 1. Standard (multi-cell), 2. 8-position micro cell, or 3. 16-position micro cell.

The screen of Fig. 12.1 is displayed after initialization. Set this to 1 when the standard sample module is used.

(2) Drive cell No.

Enter the number of cells being measured.

(3) Reagent blank corr. (cell 1)

This indicates that the sample being used as the reagent blank has been placed in the cell position 1. Enter the [3] key to switch the display between "YES" and "NO".

Refer to "12.5 About the Blank Correction Function" for details about "reagent blank correction".

(4) Cell blank corr.

Set whether or not to perform cell blank correction on the measurement results. Enter the [4] key to switch the display between "YES" and "NO".

Refer to "12.5 About the Blank Correction Function" for details about "cell blank correction".

(5) [MoveHome] (F1 key)

This moves cell 1 (the cell inserted into the front-most cell holder) into the measurement light path.

(6) [MoveCell] (F2 key)

This advances the holder one cell. If cell 6 is the cell which is currently in the light path, the holder will move to cell 1 when you press this key.

(7) [Cell Blk] (F3 key)

This acquires absorbance (transmittance) data for the cell which is inserted in the respective cell holder. Cell blank correction subtracts the absorbance acquired at this time from the sample measurement results for each cell. (The two are divided for transmittance.)

When "Cell blank corr." is set to "YES", be sure to perform cell blank correction for the cell being used.

This function operates only when "Cell blank corr." is set to "YES".

(8) [Cell = 1]

This indicates the current cell position. (Nothing will happen if you press the F4 key.)

| NOTE | Cells cannot be automatically moved and measured in modes which are accompanied by a spectrum display (Spectrum mode, Multi-component Quantitation mode). Press the [MoveCell] (F2) key when you wish to move the cell. |
|---|---|

# 12.2 CPS-240

The CPS-240 is an isothermic cell holder which is used to simultaneously hold the 6 cells at a set temperature through electronic control.

The various settings are the same as for a Multi-cell. Refer to "12.1 Multi-cell Sample Component (6-position, 8-/16-position micro multi-cell)". Refer to the CPS-240 manual regarding setting the temperature of the CPS-240.

This is an accessory that uses a pump to draw liquid sample into a flow cell.

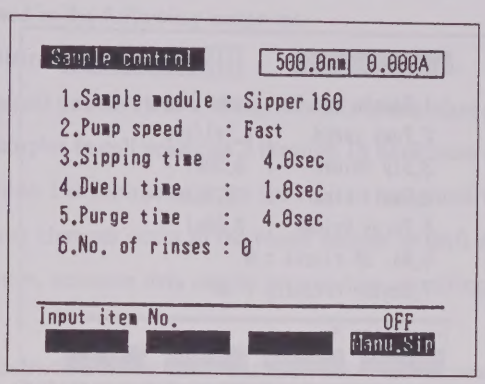


**Fig. 12.2 Sample control screen (Sipper160)**

(1) Sample module

When the sample module setting is Sipper, a screen like the one above is displayed.

(2) Pump speed

This indicates the pump rotation speed. The input range is 1 to 4: 1. Fast, 2. Medium, 3. Slow, 4. Halt. Select the 4. Halt when using the electromagnetic valve.

(3) Sipping time

Set the time that the sample will be aspirated. The input range is 0 to 99.9 seconds.

(4) Dwell time

Set the time interval between aspiration of a sample and measurement. The input range is 0 to 99.9 seconds.

(5) Purge time

Set the time after measurement is completed that the sample will be purged. The input range is -99.9 to 99.9 seconds. When set to a negative value, the pump will reverse to purge the sample, In other words, the sample will be discharged from the tube through which it was aspirated.

(6) No. of rinses

Set the number of times that the inside of the flow cell will be rinsed before measurement. The sip-purge operation will be repeated the number of times set here. Measurement is not performed during this operation.

(7) [Manu.Sip] (F4 key)

This key switches the manual suction function ON/OFF. Each time you press this key, the function toggles between ON<—>OFF. Manual sipping draws the sample while the sipper lever is pressed, regardless of the sipping time setting, and no measurement is performed.

* When using the auto sample changer ASC-5 (option) for link measurement, refer to the manual for ASC-5.

This is an accessory to sip the liquid sample to the flow cell using the syringe.



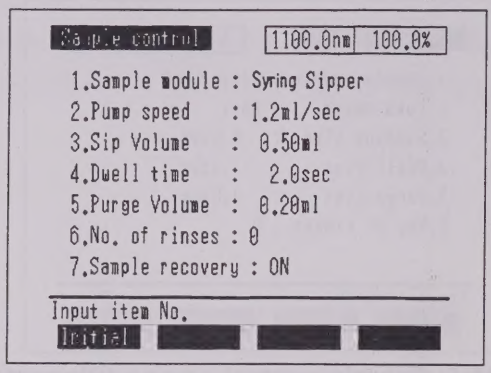


**Fig. 12.3 Sample control screen (syringe sipper)**

Initial Initialize

When the unit is connected after turning ON the power, the accessories must be initialized with F1 key. If they have not been initialized, the set capacity of sample may not be sipped or drained.

(1) Sample module

When the sample module is set to " Syringe Sipper," a screen like the one above is displayed.

(2) Pump speed

Select the pump operating speed from four steps: 1.2, 0.6, 0.3, 0.2 or 0.1 ml/sec.

(3) Sip volume

Set the sample sipping volume in the unit of ml. Input range is 0.00 to 10.00 ml.

(4) Dwell time

Set the time from sample sipping to measurement start in the unit of second. Input range is 0.00 to 9.99 sec.

(5) Purge volume

Set the sample purge volume after measurement in the unit of ml. Input range is 0.00 to 10.00 ml.

(6) No. of rinses

Set the number of times that the inside of the flow cell will be rinsed before measurement. The sip and purge operation will be repeated the number of times set here. Measurement is not performed during this operation. Input range is 0 to 4 times.

(7) Sample recovery

Select the direction to which the sample is purged after measurement, the drain nozzle side or the sipping nozzle side.

The [7] key is used to toggle Return (ON) and Discharge (OFF).

# 12.5 About the Blank Correction Function

The blank correction functions included in modes in which a Multi-cell Micro-Multi-cell or CPS-240 are available in [SmplCntl] are used in the following instances.

**1. Reagent blank correction**

Using the sample placed in cell position 1 as a blank, the cells in the other positions (2-16) are measured. In other words, after the samples in cell positions 2 through 16 have been measured, the measured value for the sample in cell position 1 is subtracted from the various measured values.

Because of this, even if time changes occur in the blank sample or drift develops due to the increasing temperature of the instrument, accurate data can be acquired by canceling these fluctuating factors.

**2. Cell blank correction**

Even though cells are constructed in the same manner, there are naturally going to be slight optical differences. In cell blank correction, at first blank samples are placed in a square cells and the measured values in that condition are recorded. Then, when an unknown sample is measured and those results are displayed, the previously recorded blank measured value is canceled from the various measurement results. Thus, the measured value of only the sample is obtained.

| NOTE | In case that you carry out "Cell blank correction" (F3) key, the correction do to all cell position in no relation to setting value of "Drive cell No." in parameter of sample compartment. |
|---|---|

If both of these two blank correction functions are functioning, the measured value for the other cells can be corrected with the sample in cell 1 as the reagent blank, while also performing a cell blank for each individual cell.

Blank correction is one type of data processing and is calculated as subtraction for absorbance and division for transmittance.

Note that the standard measurement modes in which the blank correction function can be used are the Photometric mode, Kinetics mode and one-wavelength quantitation.

## Table 11.1 Blank Correction List

| | Cell Position | | Cell blank corr.=NO Reag blank corr.=NO | Cell blank corr.=NO Reag blank corr.=YES | Cell blank corr.=YES Reag blank corr.=NO | Cell blankcorr.=YES Reag blank corr.=YES |
|---|---|---|---|---|---|---|
| Output Data | Cell n (n=2-6) | ABS | An | An-A$_1$ | An-an | (An-an)-(A$_1$-a$_1$) |
| | | T% | Tn | Tn/T$_1$×100(%) | Tn/t$_n$×100(%) | Tn·t$_1$/t$_n$/·T$_1$×100(%) |
| | Cell 1 (Cell used as reagent blank) | ABS | A$_1$ | A$_1$ | A$_1$-a$_1$ | A$_1$-a$_1$ |
| | | T% | T$_1$ | T$_1$ | T$_1$/t$_1$ ×100(%) | T$_1$/t$_1$×100(%) |

Wherein,

An: Absorbance with no blank correction on cell n

Tn: Transmittance with no blank correction on cell n

an: Cell blank value for cell n (absorbance)

n: Cell blank value for cell n (transmittance)

NOTE The range over which correction can be performed, due to internal data processing calculation restrictions, are up to 399.9% for transmittance and down to -0.602Abs for absorbance.

When a blank correction function is working, accurate data are obtained only when an actual measurement operation has been performed (when the [START] key has been pressed). Please note that the value displayed in the upper right corner of the sample control screen or measuring mode, which indicates the current value, displays the uncorrected value.

# Chapter 13 PC Control

This is the mode in which the UV-1601 is controlled by an external computer (PC). An RS-232C interface is used.

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13.1 Connecting to a PC ..... 13-1
13.2 Receiving Commands and Protocol ..... 13-3
13.3 Explanation of Commands and Data ..... 13-5
13.4 Command List ..... 13-6
13.5 Sample Program ..... 13-10

# 13.1 Connecting to a PC

Use the cable specified in the wiring specifications below as the RS-232C interface cable that connects the UV-1601 to a PC. Connect the RS-232C connector on the right side of the UV-1601 with the RS-232C connector on the PC.

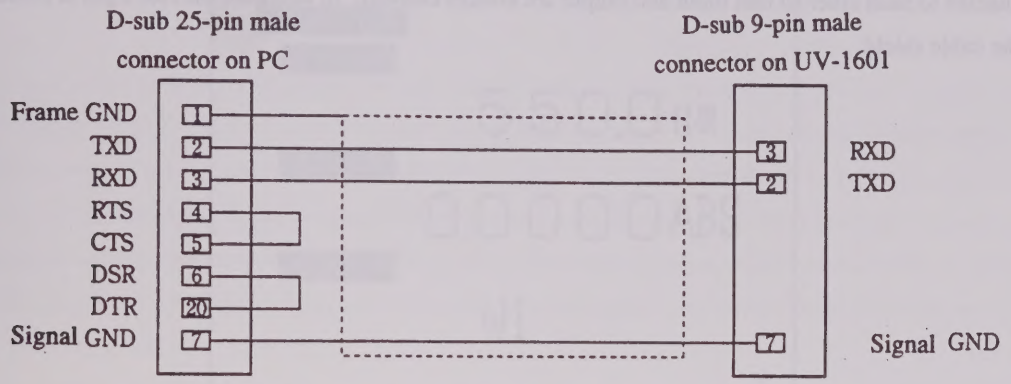



**Fig. 13.1 RS-232C cable for UV-1601**

The part number of this UV-1601 RS-232C cable is 200-86381.

A total of 3 wires are actually used: 2 for input/output and 1 for ground.

The connector for connecting to the PC, when seen from the PC side as above, has the control wire pins connected to each other so that input and output are always enabled. In addition, the No. 1 pin is connected to the cable shield.

In the case of an IBM-PC or DOS/V PC, a 9-pin, not 25-pin, connector is used on the external computer side. In this case, use a cable which is wired as shown below.

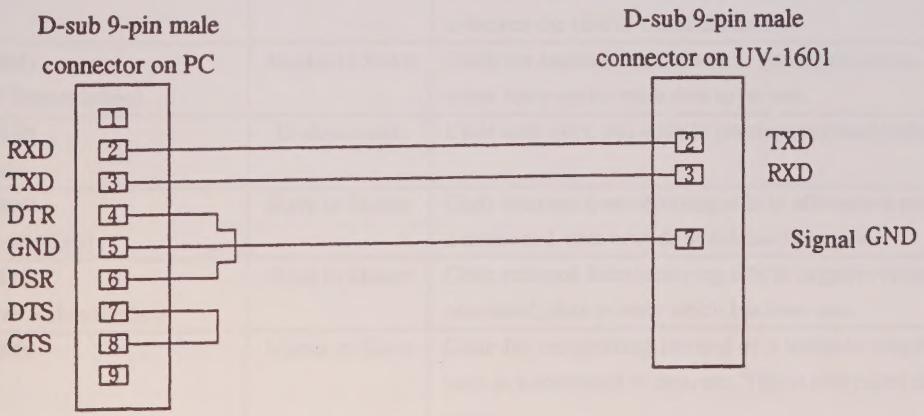



**Fig. 13.2 RS-232C cable for UV-1601 (IBM)**

The part number of this UV-1601 RS-232C cable is 200-86408.

A total of 3 wires are actually used: 2 for input/output and 1 for ground.

The connector for connecting to the PC, when seen from the PC side as above, has the control wire pins connected to each other so that input and output are always enabled. In addition, the No. 1 pin is connected to the cable shield.

When you select [PC Ctrl] (F4 key) in the mode selection screen, the following screen is displayed. It becomes possible to communicate with PC via the RS-232C interface.

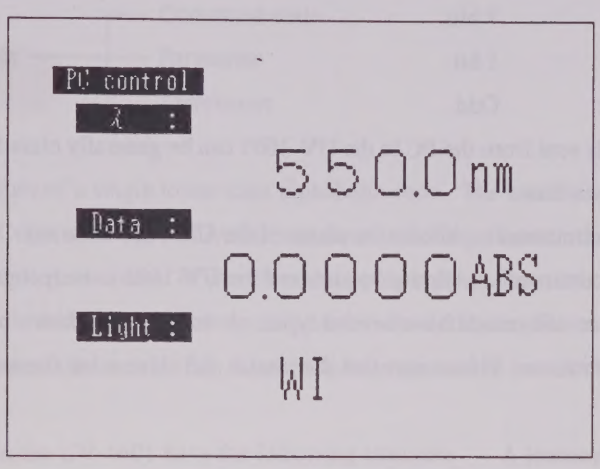



**Fig. 13.3 PC control mode screen**

The exchange of signals (communication) with the PC must be performed with one being the "speaker" and the other the "listener". In this case, the speaker will be referred to as the master and the listener as the slave.

The exchange of signals is performed under a set procedure (protocol). These signals comprise not only commands and data, but also codes for the control of the procedure (control codes). The control codes shown in the table below are used in the exchange of signals between the UV-1601 and a PC.

| Control Code (Hexadecimal) | Direction | Function |
|---|---|---|
| ENQ ($05)<br>(Enquiry) | Master to Slave | Enquiry code sent when you wish to send commands or data. In particular, the first ENQ of a series of transactions also indicates the start of communication. |
| EOT ($04)<br>(End of Transmission) | Master to Slave | Code for announcing the end of communication. Use this when there are no more data to be sent. |
| ESC ($1B)<br>(Escape) | Bi-directional | Code sent when you wish to interrupt communication. |
| ACK ($06)<br>(Acknowledge) | Slave to Master | Code returned from receiving side in affirmative response to a command, data or code which has been sent. |
| NAK ($15)<br>(Negative Acknowledge) | Slave to Master | Code returned from receiving side in negative response to a command, data or code which has been sent. |
| NUL ($00)<br>(Null) | Master to Slave | Code for recognizing the end of a variable-length signal, such as a command or data, etc. This is also called the terminator. |

**Table 13.1 Control Codes**

The transmission parameters are as follows.

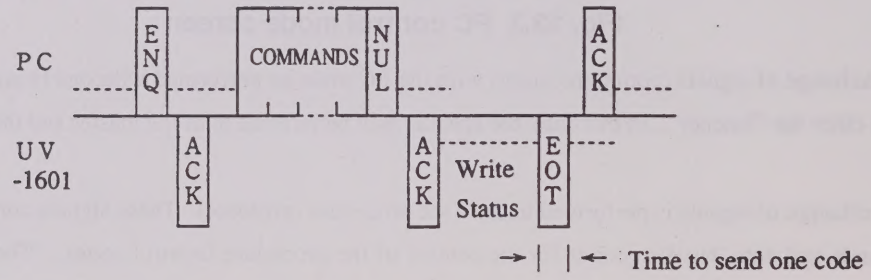
Transmission rate: 9600bps
Data bits: 7 bits
Stop bit: 1 bit
Parity bit: Odd

The types of commands sent from the PC to the UV-1601 can be generally classified as follows according to the direction of the data flow.

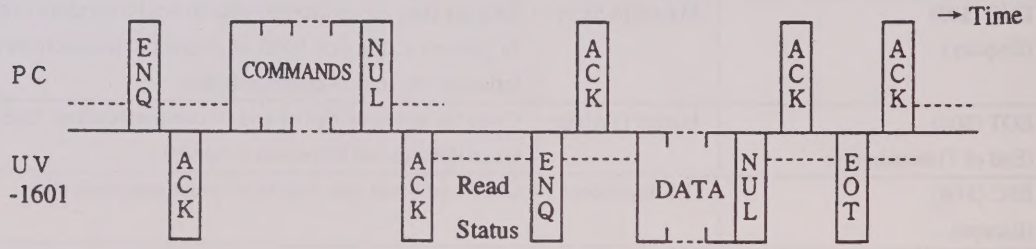
a) Write command ... Allows the status of the UV-1601 to be set.
b) Read command ... Allows the status of the UV-1601 to be recognized.

The procedures for these commands have several types. A time chart is shown below. In the figure, the '----" mark indicates the master. Please note that the master and slave roles alternate in the communication process.

a) Write command ... Protocol A




b) Read command ... Protocol B, Protocol B'

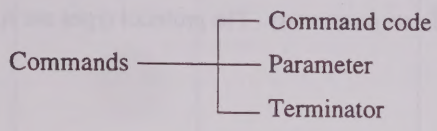



There are also repeating commands in this portion ⟷
This is Protocol B'.

The write command in a) is protocol A, the type in which data are received only once from the external computer at the read command in b) is protocol B, and when there are multiple data received it is called protocol B'.

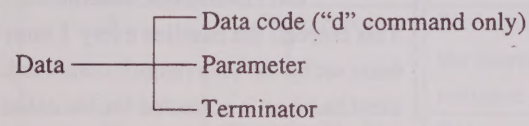
# 13.3 Explanation of Commands and Data

The commands which can be sent from an external computer are made up of the following elements.




A command code consists of a single lower-case alphabetic code. The number of a parameter is depends on the command code. Commands can be divided into those with no parameter, those with only one parameter and those with multiple parameters. When there are multiple parameters, it is necessary to separate the parameters with a symbol (delimiter). "," (comma) is used as the delimiter. Since all parameters are sent as ASCII text, if you wish to set the number 15, this would be expressed in hexadecimal as $31,$35. NUL is used as the terminator.

Data which is sent from the UV-1601 have the following structure.




Only "d" command has a Data Code "d", any other commands have no Data Code. There is only one parameter, reflected by a text string. If the parameter is 10.36, it would be expressed in hexadecimal as $31,$30,$2E,$33,$36. NUL is used as the terminator.

**CAUTION**

Not send communication command except for standard UVPC software from PC. If you send command, it is possible that the photomater initialization do not finish correctly.
In case that you control from PC except for UVPC software, certainly send command after confirming the end of initialization and entering [PC Control] (F4) mode from "Mode Selection Screen".

# 13.4 Command List

The terminator symbol has been omitted from the command format places in the command list. When sending to the UV-1601, send a terminator code (NUL) right after the content shown in the table as the actual command. "n" and "m" in the command format indicate parameters. The protocol types are A, B and B' and correspond with the time chart in 12.2.



**Table 13.2 Command List**

| Command | Protocol | Name | Processing Content and Usage Notes |
|---|---|---|---|
| a | A | Measure | Performs wavelength scan. The measured data are stored in the continuous data memory area in the UV-1601. Use the f command when retrieving data. |
| cn | A | Baseline correction | Performs baseline correction. The parameter n corresponds with the baseline number as shown below.<br>n=0: baseline<br>n=1: instrument baseline<br>This corrects the baseline every 1.6nm over the domain set by the scan range h command. The instrument baseline is corrected for the entire wavelength range at 0.1nm intervals. |
| d | B | Data output trigger | Outputs the current data. When this command is sent, the UV-1601 performs one measurement and outputs the data as shown below.<br>dk<br>The parameter k is the current data and is formatted as shown below, according to the measurement mode.<br>Abs : ±x.xxxy<br>Not Abs: ±xxx.xy<br>The sign of the parameter is output only if the parameter is negative, while a space is output if the parameter is positive. In addition, y is output if the number of columns of data display (Data display) instrument parameter for the UV-1601 is set to 5. |
| hn,m | A | Scanning range | Set the scanning range. The parameters n and m correspond with the start wavelength and end wavelength. Use a "," (comma) as the delimiter between the parameters.<br>190 ≦n,m ≦1100<br>n-m ≧ 10 |

| Command | Protocol | Name | Processing Content and Usage Notes |
|---|---|---|---|
| jn | A | Scanning speed | Set the scanning speed. The parameter n corresponds with the speed number as shown below.<br>n=1: Fast<br>n=2: Medium<br>n=3: Slow<br>n=4: Very Slow |
| vn | A | Measurement mode | Set the measurement mode. The parameter n corresponds with the mode number as shown below.<br>n=1: T%<br>n=2: Abs<br>n=3: Energy |
| wn | A | Wavelength setting (go to λ) | Set the wavelength. The parameter n uses the value which is 10 times the wavelength being set. To set a wavelength of 500.0nm, set 5000. n must meet the following condition.<br>1900 ≦ n ≦11000 |
| x | A | Auto zero | Performs auto-zeroing (sets the absorbance under the current conditions at zero, or the current transmittance at 100). |
| fn | B' | Transfer file data | Retrieves data which have been stored in the memory area of the UV-1601 by the measure command a. The parameter n is the number of data points that you wish to retrieve, and allows you to retrieve n pieces of data from the start of the file (in the case of a spectrum, from the long wavelength end). If you set the parameter to a number which is greater than the number of data points saved in the memory area, processing will end at the point where you ran out of data. n meets the following condition.<br>1 ≦ n ≦1001<br>The data will be output as follows.<br>k<br>For the data which is sent, it is necessary to send an ACK response for each piece of data. The parameter k is a pairing of the wavelength at the time of measurement and the data. The format is as follows, depending on the measurement mode at the time (Top is Abs, bottom is not Abs).<br>zzzz.z Δ Δ ±x.xxxy |

| Command | Protocol | Name | Processing Content and Usage Notes |
|---|---|---|---|
| | | | zzzz.z Δ Δ ±xxx.xy<br>z is the wavelength, x and y are the measurement data and Δ represents "space" data. The sign of the parameter is output only if the parameter is negative, while a space is output if the parameter is positive. In addition, y is output if the number of columns of data display (Data display) instrument parameter for the UV-1601 is set to 5. |
| o | A | Sipper suction | Execute the sipper suction operation. The settings done on the UV-1601 are used for the sipper parameters at the Spectrum mode, such as pump speed and sip time, etc. This command is valid only if a sipper 160 is connected to the sample compartment module. |
| p | A | Sipper purge | Execute the sipper purge operation. The settings done on the UV-1601 are used for the sipper parameters at the Spectrum mode, such as pump speed and purge time, etc. This command is valid only if a sipper 160 is connected to the sample compartment module. |
| qn | A | Move cell position | Move the cell position of the Multi-cell, Micro-Multi-cell holder or CPS-240. Parameter n decides the direction.<br>n = 1: Move 1 cell forward (Multi-cell & CPS-240)<br>n = 2: Move to the cell 1 (Multi-cell)<br>Move 1 cell backward (CPS-240)<br>This command is valid only if Multi-cell, Micro-Multi-cell or CPS-240 is connected to the sample compartment module. |
| q | B | Check cell position | Check the cell position in the multi-cell, Micro-Multi-cell or CPS-240.<br>When this command is executed, data are returned from the UV-1601 as follows.<br>k<br>The parameter k corresponds with the cell position number as follows.<br>1≦k≦16<br>This command is valid only when a multi-cell, Micro-Multi-cell or CPS-240 is connected to the sample compartment module. |
| r | B | Check ASC nozzle | Check the nozzle condition in the auto-sample |

| Command | Protocol | Name | Processing Content and Usage Notes |
|---|---|---|---|
| | | | changer ASC-3 or ASC-5 (both options). If this shows that the nozzle is lowered, the sample suction operation can begin. When this command is executed, data are returned from the UV-1601 as follows.<br>k<br>The parameter k corresponds with the nozzle status number as follows.<br>0= nozzle is raised<br>1= nozzle is lowered<br>This command is valid only when the ASC-3 or ASC-5 is connected. |
| mn | A | Option initialization | Execute the initialization of option unit is connected to the sample compartment.<br>n=B : multi-cell (6 cell)<br>=C : CPS-240<br>=D : micro-multi-cell (8 cell)<br>=E : micro-multi-cell (16 cell) |

# 13.5 Sample Program

Sample programs 1, 2 and 3 will be introduced for the protocol types A, B and B' described in Section 12.2. BASIC is used as the program language. These will run on NEC 98 series computers or IBM personal computers and their compatibles.

So that these will operate independently, insert a statement to initialize the RS-232C port in the front half of the program (the line OPEN "COM1:...). However, Since there is no statement for setting the transmission rate for an NEC 98 series computer, refer to the operating manual for the PC that you will be using and set the transmission rate to 9600.

The program list shown below will run on an NEC 98 series computer. For an IBM personal computer, modify the initialization statement for the RS-232C port as follows.

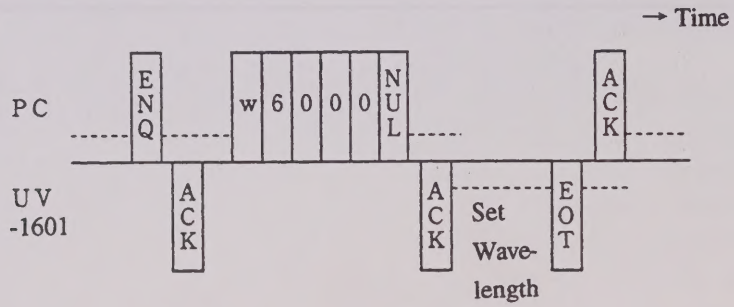
OPEN "COM1:9600,O,7,1" AS #1

Program 1. (Sample program for Protocol A)

Content:

Set the wavelength to 600.0nm.

Protocol Procedure:




Program List:

```
100  'UV-1601 PC Control Program
110  DIM BUF$(32)
120  ENQ$=CHR$(&H5) : EOT$=CHR$(&H4) : ESC$=CHR$(&H1B)
130  NUL$=CHR$(&H0) : ACK$=CHR$(&H6) : NAK$=CHR$(&H15)
140  '
150  'GO TO λ
160    PEN "COM1:O71NN" AS #1
170  FOR I=0 TO 99 : NEXT
180  PRINT #1,ENQ$;
```

```
190   IF INPUT$(1,#1)<>ACK$ THEN 170
200   FOR I=0 TO 99 : NEXT
210   PRINT #1, "w6000" +NUL$;
220   IF INPUT$(1, #1)<>ACK$ THEN BEEP : PRINT #1, ESC$; : GOTO 250
230   IF INPUT$(1, #1)<>EOT$ THEN BEEP : PRINT #1, ESC$; : GOTO 250
240   PRINT #1, ACK$;
250   CLOSE #1
260   END
```

Explanation of Program List:

| | |
|---|---|
| Line 110 | Define receiving buffer |
| Lines 120-130 | Define control codes |
| Line 160 | Set transmission parameters for RS-232C (Data: 7 bits, Stop: 1 bit, Parity: odd) |
| Lines 170, 200 | Timing adjustment. Since processing speed of the UV-1601 is slower than that of the PC, standby time is inserted. |
| Lines 180-190 | Send ENQ, receive ACK |
| Lines 210-220 | Send command, receive ACK |
| Lines 230-240 | Receive EOT, send ACK |
| Line 250 | Close RS-232C port |

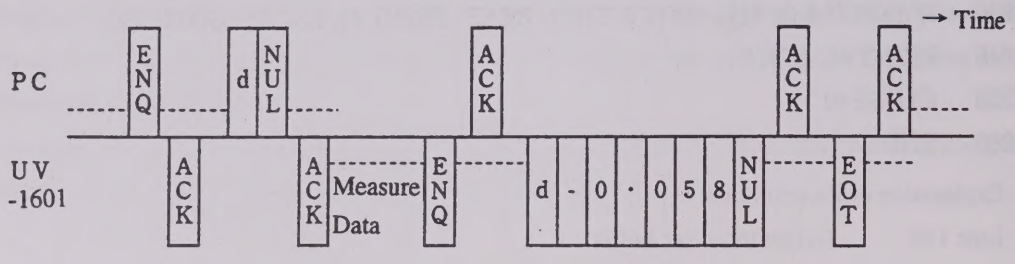
Program 2. (Sample program for Protocol B)

Content:

Retrieve and display current data.

Protocol Procedure:






Program List:

```
100   'UV-1601 PC Control Program
110   DIM BUF$(32)
120   ENQ$=CHR$(&H5) : EOT$=CHR$(&H4) : ESC$=CHR$(&H1B)
130   NUL$=CHR$(&H0) : ACK$=CHR$(&H6) : NAK$=CHR$(&H15)
140   '
150   'Trigger
160   OPEN "COM1:O71NN" AS #1
170   FOR I=0 TO 99 : NEXT
180   PRINT #1, ENQ$;
190   IF INPUT$(1, #1)<>ACK$ THEN 170
200   FOR I=0 TO 99 : NEXT
210   PRINT #1, "d" +NUL$;
220   IF INPUT$(1, #1)<>ACK$ THEN BEEP : PRINT #1, ESC$;: GOTO 320
230   IF INPUT$(1, #1)<>ENQ$ THEN BEEP : PRINT #1, ESC$;: GOTO 320
240   PRINT #1, ACK$;
250   BUF$=""
260   C$=INPUT$(1, #1)
270   IF C$<>NUL$ THEN BUF$=BUF$+C$ : GOTO 260
280   PRINT #1, ACK$;
290   PRINT "Current data:"; MID$(BUF$, 2, LEN(BUF$))
300   IF INPUT$(1, #1)<>EOT$ THEN BEEP : PRINT #1, ESC$;: GOTO 320
310   PRINT #1, ACK$;
320   CLOSE #1
330   END
```

Explanation of Program List:

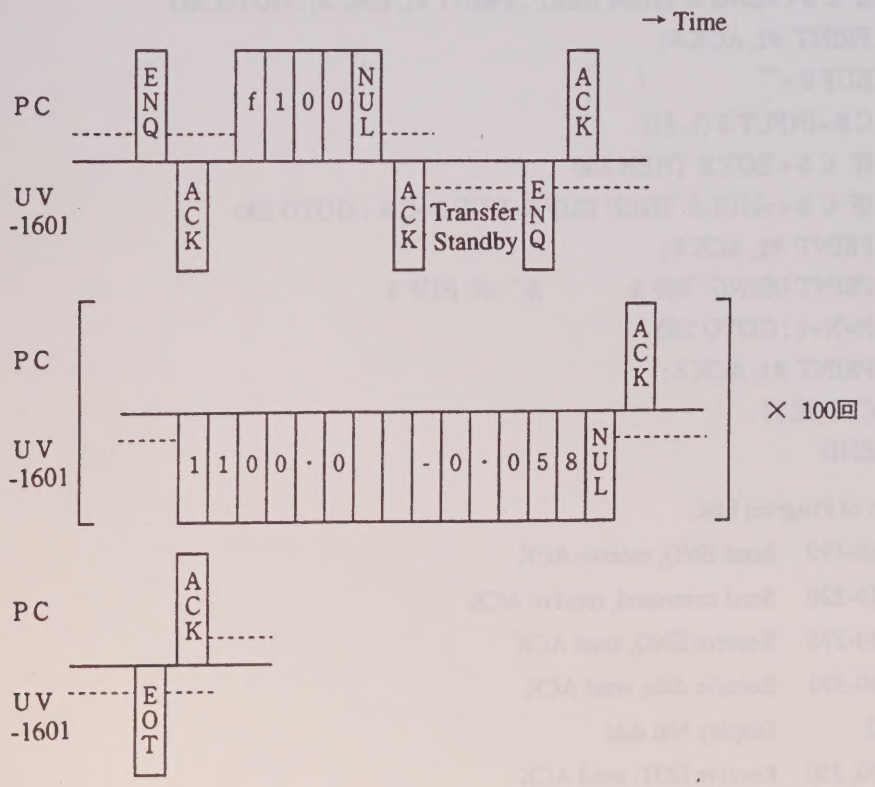
| | |
|---|---|
| Lines 180-190 | Send ENQ, receive ACK |
| Lines 210-220 | Send command, receive ACK |
| Lines 230-240 | Receive ENQ, send ACK |
| Lines 250-280 | Receive data, send ACK |
| Line 290 | Delete data code at head of data, display current data |
| Lines 300-310 | Receive EOT, send ACK |

Program 3. (Sample program for Protocol B')

Content:

Retrieve 100 points of data for kinetics or spectrum which were obtained from a spectrum obtained by measurement command a or by key operation of the UV-1601 instrument. This sample is programmed so that the loop, rather than continuing until 100 points are received, continues until an EOT signal is received from the UV-1601.

Protocol Procedure:



Program List:

```
100   'UV-1601 PC Control Program
110   DIM BUF$(32)
120   ENQ$=CHR$(&H5) : EOT$=CHR$(&H4) : ESC$=CHR$(&H1B)
130   NUL$=CHR$(&H0) : ACK$=CHR$(&H6) : NAK$=CHR$(&H15)
140   '
150   'Transfer Data File
160   OPEN "COM1:O71NN" AS #1
170   FOR I=0 TO 99 : NEXT
180   PRINT #1, ENQ$;
190   IF INPUT$(1, #1)<>ACK$ THEN 170
200   FOR I=0 TO 99 : NEXT
210   PRINT #1, "f100" +NUL$;
220   IF INPUT$(1, #1)<>ACK$ THEN BEEP : PRINT #1, ESC$;: GOTO 360
230   N=1
240   C$=INPUT$(1, #1)
250   IF C$=EOT$ THEN 350
260   IF C$<>ENQ$ THEN BEEP : PRINT #1, ESC$;: GOTO 360
270   PRINT #1, ACK$;
280   BUF$=""
290   C$=INPUT$(1, #1)
300   IF C$=EOT$ THEN 350
310   IF C$<>NUL$ THEN BUF$=BUF$+C$ : GOTO 290
320   PRINT #1, ACK$;
330   PRINT USING "### &          &" ;N, BUF$
340   N=N+1 : GOTO 280
350   PRINT #1, ACK$;
360   CLOSE #1
370   END
```

Explanation of Program List:

| | |
|---|---|
| Lines 180-190 | Send ENQ, receive ACK |
| Lines 210-220 | Send command, receive ACK |
| Lines 240-270 | Receive ENQ, send ACK |
| Lines 280-320 | Receive data, send ACK |
| Line 330 | Display Nth data |
| Lines 300, 350 | Receive EOT, send ACK |

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